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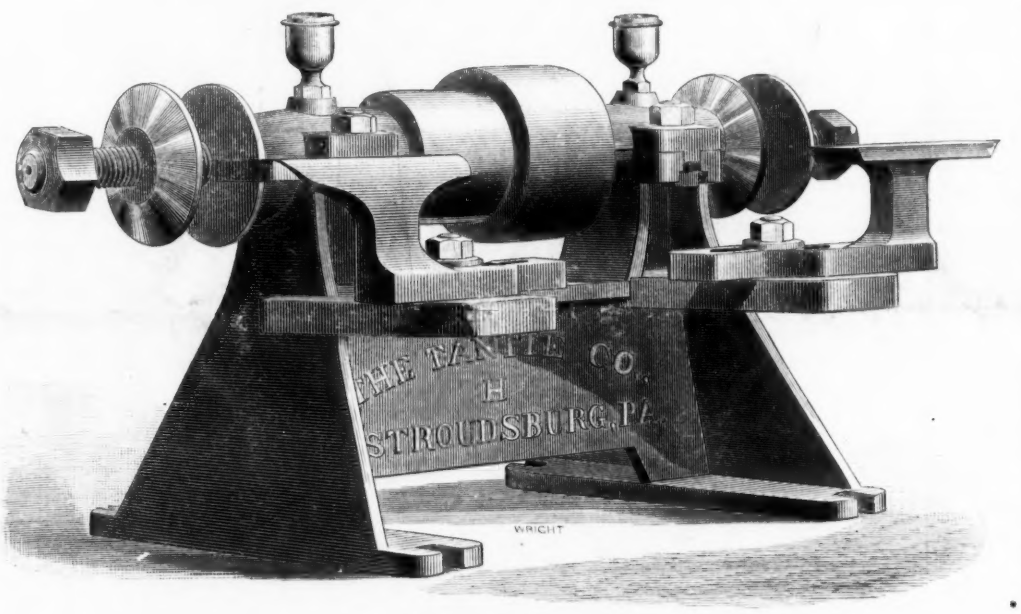
New Emery Grinder.

The engraving represents a new machine in this line, made by the Tanite Co., Stroudsburg, Pa. This machine is intended to meet the demand for a simple grinding machine without unnecessary complication, but with the requisites of solidity and stability.

The machine takes a floor space of $14\frac{1}{4}''$x $11\frac{1}{4}''$ and the center of spindle is $8\frac{1}{4}''$ from table. The spindle is steel, $23\frac{1}{4}''$ long, $1\frac{1}{16}''$ diameter in boxes, and is intended to carry emery wheels of $12''$x$2\frac{1}{2}''$, with $1''$ hole. The boxes are $3\frac{3}{4}''$ long; pulleys, $2\frac{1}{2}''$ face, $3''$ and $4''$ diameter; flanges, $3\frac{1}{2}''$ diameter.

Overhead work has cones $12''$x$13''$x$2\frac{1}{2}''$ face; tight and loose pulleys, $6''$ diameter by $3''$ face; countershaft, $23''$ long by $1\frac{1}{16}''$ diameter; adjustable hangers and belt shifter. The machine weighs 61 pounds.



NEW EMERY GRINDER.

Steel Castings.

In a paper read at the September meeting of Mining Engineers, by Arthur V. Abbott, he gives the results of some experiments as to the strength of steel castings from different makers. The specimens broke under tensile strains varying from 32,151 to 63,058 lbs. per square inch of section, and showed about equal variation under transverse stress. Mr. Abbott concludes as follows:

"The economic value of steel castings is a matter so largely dependent upon the circumstances of each particular case that a generic statement is hardly possible. Where a large number of similar castings are required, the cost of the pattern, unless exceedingly complicated, is too small to affect the price of the product, which may be generally stated at about 11 cents per pound. Where but a single casting is required, the cost of the pattern will increase that of the casting from 10 to 50 per cent. Thus it may be safely assumed that the net cost of steel castings as they come from the sand will rarely exceed 15 cents per pound unless the articles are very small and light. This is about 30 per cent. higher than the usual prices for iron and steel forgings. Yet for shapes that are at all complicated the steel casting is much the more economical, inasmuch as there is little or no waste metal, nor is any expensive machine work required to dress the rough hammered piece to its appropriate shape. Therefore, for parts of machinery that are subjected to anything but direct compression, the steel casting may be, as at present made, considered the successful rival of forged work. Where, however, compression is alone to be resisted, cast iron will for a long time to come hold its own, for, subjected to this stress, the steel is but little superior to the iron, and the great difference in price will long continue to make iron the successful competitor."

In discussing the paper, Mr. Collingwood said:

"The subject treated by Mr. Abbott is one that has occupied the attention of foreign engineers for some time, and it may be of interest to review some of the results thus far obtained, more especially as they seem to be more favorable than those obtained here. Mr. William Parker, chief engineer of Lloyds, states that stern-frames, rudders, and stem-pieces of ships, also crank-shafts up to 8 tons weight, and a gun carriage 28 tons in rough and 17 tons finished, have been cast in steel, and are giving entire satisfaction, also locomotive axles. Great stress is laid by French engineers on the necessity for prompt removal from the moulds and annealing and tempering in oil after removal. A test of a casting unannealed gave a tensile strength ot 32 tons and 16 per cent. stretch; when annealed, $33\frac{7}{10}$ tons and 17 per cent.; and when tempered in oil, $38\frac{6}{10}$ tons and 17 per cent. The tests by torsion, extension, transverse strains, percussion, rolling and hammering, and drop tests, all gave more favorable results than the same on wrought iron. Transverse tests of rough bars cast 1 inch square gave a strain in exterior fibers of 53,000 to 85,000 lbs. per square inch, and while tempered in oil 102,000 lbs., and, after planing, similar bars bent 90° to 100° before failure. It is claimed that for large masses hammering does no good, as it does not reach to the interior, and for this reason large shafts, etc., are just as likely to be sound when cast directly as when forged. Failures which have taken place, it is claimed, can all be traced to a lack of the precautions necessary for sound work. A recent paper describes a method of making castings from wrought-iron scrap, which has been very successful. The result when best Swedish scrap was used, was to increase the strength of the iron about 20 per cent., and to diminish the elongation about 5 per cent. The iron is cast at a high temperature, and the moulds are specially prepared."

More observation of the effect of introducing feed-water at different points in a boiler is desirable. The custom is too much in the direction of feeding at the most convenient point, and the results are sometimes unfortunate. More light on the best plan of introducing feed-pipes is needed.

Fuel Economy of Locomotives.

BY PROF. A. T. WOODS.

In a recent French work on American railroads* is a statement of which the following is the substance: "The style of construction peculiar to American locomotives is not calculated to reduce the fuel consumption to that of European locomotives. The small proportion of heating surface due to short tubes is as little qualified to utilize the heat produced by means of large grates as the very restricted use of expansion in the cylinders is to obtain the maximum work from the steam. Consequently, it is not surprising that, while an average of 35 lbs. of coal per locomotive mile is not considered low in France, American locomotives still average about 56 lbs."

This led the writer to make a few comparisons between *average* bituminous coal passenger engines in this country and those used in France and England, omitting all of the special forms of boilers and engines which are in use on a few of our railroads, but which are not yet in general use. These comparisons are now called to mind by an article which has recently appeared in technical papers, in which various changes, and some of them startling ones, from an M. E., are recommended as the necessary means by which to produce an efficient locomotive.

Now, the writer believes that there is undoubtedly much room for improvement in some classes of engines, but also that as high an efficiency can be and is obtained by careful firing, from some American engines now in use, as from any simple foreign locomotives. And, further, that the immediate causes which result in a high average consumption of coal are simply overwork, careless firing and insufficient boiler power for the sizes of cylinders used. These faults can be corrected without using larger grates than many now in use, and other improvements can then be added without necessarily remodeling the whole machine.

*"Les Chemins de Fer en Amerique," by Lavoinne and Pontzen.

As to overwork, it is well known that there are locomotives in all parts of the country which, apparently intended for the slow speeds of a few years ago, are now forced beyond all region of economy to haul trains at a speed of 50 miles per hour or over. When we consider that, for example, a 16×24 engine, with $62''$ drivers, has at the above speed a mean piston speed of 1,085 feet per minute, compared with a piston speed of 862 feet per minute for the same engine, with $78''$ drivers, and also consider the volume of steam thus required of a small boiler and small grate area, no one can doubt the overwork.

In regard to careless firing, while it is by no means an easy matter to prevent escape of steam at the safety valve, it is evident to any observer that much steam, and consequently much coal, is thus wasted daily on many roads. The cause is probably to be found in the fact that in most cases the engineer and fireman have very little, if any, interest or object in saving coal.

In regard to the relative proportions of cylinders and boilers, it would seem that the importance of their relative size is too often underestimated. For comparison, take (*a*), an American type, 17×24 engine, with $66''$ drivers, and (*b*), a Paris, Lyons and Mediterranean express locomotive, having cylinders $19.7''\times25.6''$ and $82.7''$ drivers. Suppose each to be running so that the cylinders are to be half-filled with steam from the boilers at each stroke, and consider the number of cubic feet of steam required by each to run a mile. The first requires

$$2\left(\frac{5280}{17.28}\right)\times\frac{226.98\times24}{1728}=1923 \text{ c. ft.}$$

The second requires 2,203 cubic feet, but the boilers are so proportioned that while (*a*) requires about 117 cubic feet of steam per square foot of grate, and 1.9 cubic foot per square foot of heating surface, (*b*) requires but 96 and 1.5 cubic feet respectively. The average results of the comparison referred to above, while not differing as much as the two engines just mentioned, showed that we require of our ordinary bituminous coal passenger engines, as compared with sample French and English engines doing the same class of work, from each square foot of grate, 12 per cent. more steam than French, and 8 per cent. more than English, practice demands; and from each square foot of heating surface 22 per cent. more steam than French, and 17 per cent. more than English, practice.

In these comparisons, the average results for the boilers, taken apart from the engines, do not vary widely. The ratios of total heating surface to grate surface were about 67 to 1 for the foreign boilers, and 62 to 1 for the American; those of total heating surface to direct (fire-box) heating surface were, approximately, 15 to 1 for French, 11 to 1 for English, and 9.5 to 1 for American; while the ratios of grate area to cross area of tubes were 6.8, 6, and 5.9 to 1 in the same order. It would appear that we make up in direct-heating surface what is lost by larger and shorter tubes. All of the above figures

should be accepted with some allowance, for, although they represent an apparently fair average, the number of locomotives considered was small. It is true that many of our latest locomotives are being better proportioned than those considered; and with proportionally larger boilers, larger driving-wheels for high speeds and greater boiler pressure, they are showing a corresponding economy, as might be expected. But the majority of passenger engines in use are of about the proportions here given, and, what is more to be regretted, more have been recently built. While it cannot be said that master mechanics are unprogressive, for to some of them we are indebted for nearly all of the practical improvements in locomotives of all classes, there still seems to be a disinclination on the part of many to adopt improvements which have been tested and approved by others.

The writer concludes that the average American passenger engine can be made more economical, by a more ready adoption of appliances which have been proved to work well; by proportioning boilers with more regard to the amount of steam they will be required to furnish; by a system of premiums which will save coal directly, by giving the firemen a substantial reason for saving it, or by a blow-back to save coal by utilizing the waste from safety-valve; by an increase of boiler pressure; and by adopting a valve-gear which will give at early cut-offs a good diagram, compared with the theoretical card. When this is done, it will be time enough to figure on compounding.

Shop Notes.

Buncomb has got an old hand-gear cutter. He uses that tool for a kind of universal milling machine. It has a hand-feed, and hand-setting. Every adjustment is by hand, and Buncomb calls it a "handy machine."

One day Buncomb started the machine on 300-8″ spur-gears, and gave Joe the job of setting and feeding.

Buncomb went to town and Joe got lazy. He cut two of those gears; there were 80 teeth in each gear, and it took him eight hours to cut the two. He could'nt cut four or five at once. The spindle would not stand it. Joe figured out the fact that he could loaf some if the machine was self-feeding. He picked up two bevel-gears; put one on back of the hand-wheel, as shown at *C*. The other gear *D*, he put on a short shaft, and bolted it to the carriage which carried the feed screw. Upon the end of this arbor, he put the pulley *E*.

B is the pulley which drives the machine from the belt *J*. Joe put the pulley *A*, just back of *B*, as shown.

Now, as *A* and *B*, must rise and fall every time the machine is changed, and *E* is continually moving in two planes, Joe thought first of an india-rubber belt, and then he thought of the round belts used with portable drills.

B and *E* were nearly in line. Joe got four pulleys about 4″ in diameter. They were fitted with screw shanks, and he screwed them into a floor joist as shown by *I*, I^1, I^2 and I^3. Another pulley was fitted with a weight *H*, like *G*.

Joe got a ¼″ round belt *K*, and belted his machine as shown in the cut. As seen by the arrows, none of the working pull comes upon the weighted pulley *G*, therefore it has nothing to do but keep the belt tight, and move up and down as *B* and *E* change their position. As all the pulleys have their faces grooved to fit the belt, there is no danger of its running off, even if the pulleys get badly out of line.

When Buncomb got home next day, Joe was doing "government" work on a little steam-engine, and listening for the gear-cutter to get through a cut.

Buncomb looked it all over, and gave Joe $5. Buncomb straightway went to work, and rigged the thing on a lathe.

He put a pulley on the cross-feed, just as Joe did with the gear-cutter, and put another pulley on the biggest change gear he had. A little figuring gave him the speed; the gear and pulley were put on the second stud, and driven by gearing from the spindle.

A double-sheave pulley-block, hung overhead answered for *I*, and I^1, and another block answered for I^2 and I^3.

Only one thing bothered Buncomb. It required a heavy weight at *H*, to prevent the belts slipping on *E*, but he soon cured this by turning a broad groove on *A* and *E*, and then giving the belt a whole turn around both pulleys.

Buncomb says that the next lathe he rigs, he shall run *K* right along level with the bottom of *E*, and let it return over head; he will need no more pulleys, and the belt will be out of the way.

The handle *F*, is loose in the hand-wheel. It ships into a hole *C*, and is held by a spiral spring between *F* and *C*, and bearing against *F* and a small pin through the large one, close to *C*. Buncomb says he don't know of any patent on the device, and that it works first rate.

Tests of Relative Strength of Different Foundry Mixtures.

BY ROBERT E. MASTERS.

Since my article on "Toughened Cast Iron" appeared in the AMERICAN MACHINIST, Oct. 3d, there has been so much interest expressed on that subject in letters to me from manufacturers, I concluded to make a series of tests on the relative strengths of the different mixtures.

On asking permission of Mr. William H. Wheeler, manager of the Eclipse Wind Engine Company, to have these tests made, he not only granted permission but stated that he would furnish anything that I required to make them. I then laid my plans before Prof. Charles I. King, instructor in practical mechanics, and superintendent of the machine shops of the Wisconsin State University at Madison. He very kindly offered to make the tests for me, and I now have the pleasure of placing the result before the readers of this journal.

Test bars were made in two sizes 1″ square, and ½″ square, each 8″ long, moulded and poured in a horizontal position. The moulding and pouring of each set of bars was done as near alike as skill would permit. The bars were gated at each end. We poured the metal in at one end and flowed fifteen pounds through at the other end. Before pouring, the metal for each set was allowed to cool to about the same temperature, as near as we could judge, which was rather dull.

The charges in the cupola were 2,400 pounds each, made of a mixture of 50 per cent. American Scotch (soft iron) from a black brand obtained at Mineral Ridge, Mahoning County, Ohio. (It is a coke iron known as Hazleton number one.) 33⅓ per cent. hot-blast charcoal iron made from Lake Superior ore, from Outagamie County, Wisconsin and known as Appleton (hard) No. 2, 16⅔ per cent. good machine scrap.

I first poured a set of bars from this mixture alone. I then took three ladles and put 150 pounds of this mixture into each. To one I added 20 pounds cast-steel scrap, another 20 pounds malleable iron, and the other 20 pounds of wrought iron. This made the mixture in each of these three ladles, Hazleton, $44\frac{2}{17}$ per cent.; Appleton, $29\frac{7}{17}$ per cent.; Scrap, $14\frac{13}{17}$ per cent., and the other metals $11\frac{13}{17}$ per cent., unless my "arithmetic is twisted." After the bars had been cleaned, I marked each bar so that there would be no mistake made. In addition to this I had some forms written out for each bar leaving a space blank for the number of pounds of each test.

Prof. King tells me he was very careful to fill out the blank space immediately on testing each piece. The following is the result:

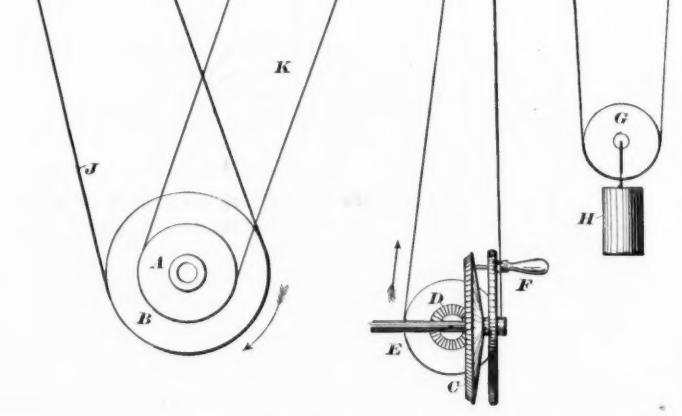
Tensile Strain Bars 1″ Square.

Cast Iron alone	18,770	lbs.
Cast Steel Mixture	28,130	"
Malleable Iron "	18,610	"
Wrought " "	23,530	"

The bar of Malleable iron mixture had a small flaw in it.

Transverse Breaking Load—Bars 1″ Square 4″ Between Supports.

Cast Iron alone	5,240	lbs.
Cast Steel Mixture	10,770	"
Malleable Iron "	8,160	"
Wrought " "	7,700	"



The test for compression was made on pieces ½″ square, as their testing machine was not capable of crushing bars 1″ square.

In this table of tests it will be noticed I have the results on all-steel rail and all-steel scrap; these were two pieces ½″ square that I had saved as the result of some of my experiments made at the Columbus Iron Works. The steel rail bar was a casting made from all-steel rails melted in a cupola without any other mixture. The other was a cast bar of all-agricultural-steel scrap.

Compression or Crushing Force Required on Bars ½″ Square.

Cast Iron alone	28,250	lbs.
Cast Steel Mixture	37,400	"
Malleable Iron "	32,290	"
Wrought Iron "	38,540	"
Steel Rail Casting	35,300	"
Scrap Steel "	40,000	"

Transverse Breaking Load—Bars ½″, 2″ Between Supports.

Cast Iron alone	2,180	lbs.
Cast Steel Mixture	3,180	"
Malleable Iron "	3,000	"
Wrought " "	3,450	"
Steel Rail Casting	2,400	"

The scrap-steel casting was not long enough to get a transverse test made. In the tests for compression all of the pieces broke diagonally the length of the bar from the upper to the lower end, except the steel rail and scrap-steel bars. The steel rail bar, parted exactly through the center from end to end. The steel-scrap bar was crushed all around the upper portion leaving, the lower half intact.

We then reversed the mixture, using 50 per cent. Appleton, No. 1 (hard); 33⅓ per cent. Hazleton No, 1 (soft), and 16⅔ per cent. machine scrap. The bars cast and tests made on the same plan as the others show equally satisfactory results of all the mixtures over cast iron alone. The Malleable iron bar in this last mixture was sound and stood a tensile strain of 26,000 pounds.

I am aware that had these bars been poured in a vertical position with good hot fluid mixtures they would have shown higher figures, but as my only object was to see what they would stand in comparison to each other, I let the ladles stand after the other metals had been put in them and stirred them up until I was sure the mixture was thoroughly made, which made the metal rather dull.

One of the most essential things about an insurance company is that the financial condition be sound. Reports having been circulated detrimental to the Hartford Boiler Insurance Company in the Northwest, the Insurance Departments of Minnesota and Illinois made a careful examination at the company's request last August. In the report they say:

"The financial condition of the company is in every sense satisfactory. It had on the 10th of August, inst., $527,194.55 of good interest-paying assets, and but $172,561.53 of liabilities, aside from its $250,000 of capital stock, and showed a clear surplus to policy-holders of $354,633.02, and a net surplus of $104,633.02. The investments of the company may be regarded as first-class. It is rather a remarkable fact that out of a total of 257 real estate mortgages, securing $216,300 of loans, there is no over-due interest. We found the books, papers, and accounts of the office in admirable shape. Order and method prevailed in all parts of the company's business. Its management is able and skillful. We were especially impressed with the small proportion of "losses" to the total expenditures. The governing idea in the company's business seems to be, "an ounce of prevention is worth a pound of cure," and consequently its heaviest expenditures are incurred in its inspection, or what might be called its "preventive" department. In 1884 it expended in this department $101,954.66, and its total losses were but $16,278.34. It is very plain that the small loss account is but the inevitable consequence of the admirable and thorough inspection system enforced by the company. It would be a blessing to the country if the same system could be generally applied to the fire insurance business.

"It affords us much pleasure to be able to testify to the soundness and strength of the Hartford Steam Boiler Inspection and Insurance Company. It has no weak places under its present able management, and is not likely to develop any. The company is worthy the fullest confidence."

A New Feature in a Rope Railway.

In the rope railway proposed to be built at Genoa, from Balzaneto to the Madonna della Guardia, no stationary engine will be required, as Mr. Agudio, the engineer, intends utilizing the power of the same locomotive that will be employed for bringing the train from Balzaneto to the foot of the incline to the sanctuary, a vertical height of 700 metres (2,296 feet). This power will be transmitted, as in the case of the Superga line, by an endless wire rope, driven at a high speed, to a specially constructed apparatus, or "locomotore," which receives the energy thus conveyed to it, and utilizes it for the direct haulage of the train. In this way, one of the principal drawbacks in the application of this system will be avoided, as the traffic on such lines is very variable, and the expense of keeping a stationary engine of at least 250 horse-power, forms a serious item in the working expenses.—*The Machinery Market.*

The malleable iron fitting companies throughout the United States have advanced prices ten per cent. and say the state of trade warrants it, all being behind on orders.

Twist Drills.

BY WILLIAM H. THORNE, PHILADELPHIA, PA.

A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The following paper is offered as an inquiry into the requirements of the cutting edges of twist drills, and as a suggestion of a mode of procedure by which a proper form for them may be determined.

Each lip of a drill is required to cut a shaving from a metal surface and should be in the shape of a wedge. The angle included between the faces of the wedge, will be called the cutting angle, and that between the surface being cut and the adjacent face of the wedge, the angle of clearance. In order to secure the greatest efficiency in cutting different metals, these angles should be varied, but on acconnt of the inconvenience of having to keep a different set of drills for each metal, a compromise has been evolved which is reasonably efficient for them all. It is known that the best cutting angle for wrought iron is about 60 degrees and for cast iron about 70 degrees, the angle of clearance being from 3 to 5 degrees; hence, if we take 65 degrees as the cutting angle of a drill, it will answer for either metal.

The body of a twist drill is a cylinder, grooved on two opposite sides. The intersections of these grooves with the end of the drill form two lines, the straight portions of which should be parallel with each other and at a distance apart equal to about one-eighth of the diameter of the drill and leading from the circumference a little past the axis, then curving backward in a direction opposite to that of the rotation of the drill and again touching the circumference at a distance of rather more than a quadrant from the starting point, as shown by the accompanying drawing (Fig. 61). If these grooves were parallel with the axis, it is evident that the cutting angles of the drill would be 90 degrees, less the clearance, or say 85 degrees. In order to reduce these angles to 65 degrees, the amount required, the grooves are cut spirally, making the angle of the spiral about 20 degrees, or its pitch about nine times the diameter of the drill. This makes the cutting angle correct only at the part of the lip farthest from the axis, while it will increase in magnitude from this point in to the point nearest to the axis; but, as the speed diminishes at the same time, this increase of the cutting angle is not objectionable. For brass, the cutting angle should be from 80 to 90 degrees; therefore it is best either to use a flat drill or to alter the cutting angles of the twist drill by grinding off the lips by planes parallel to the axis and to each other. Another object in making the grooves spiral, is the lifting or screwing out of the chips from the hole which is drilled.

The distance between the parallel sides of the grooves at the axis gives the necessary strength to the center or web, while the strength and stiffness of the drill are further increased by the metal adjoining the curved parts of the grooves. The cylindrical portions of the drill, which are left between the grooves, should be backed-off from their forward edges, in order to diminish the rubbing surface and to prevent undue friction and sticking.

The angle of clearance of the lips is obtained by the shape to which the end surfaces of the drill are ground, and the straight part of the intersections of these end surfaces with the grooves forms the cutting edges. The most efficient shape for these end surfaces can best be determined by considering that the surface of the metal being cut is in the form of a hollow cone, truncated a certain amount, depending on the thickness of the web of the drill. The cutting edges of the drill will touch this hollow cone in straight lines. Now, imagine a portion of a conical surface to coincide with this hollow cone and then to be rotated about one of these straight lines through an angle of, perhaps, 5 degrees. It is evident that this would produce an uniform and similar clearance throughout, and would form the most perfect clearance possible. It is the object, therefore, to approximate this in shaping the end of the drill. As the two cutting edges are straight lines, parallel to each other, but at a distance apart equal to the thickness of the web, and as each is produced by the intersection of a conical surface with one of the grooves of the drill, these conical surfaces must be selected so that their intersection with each other will produce a proper form of chisel point, and so that they will approximate as nearly as possible to the surface of the hollow cone.

The accompanying illustration (Fig. 61) represents on a scale of one quarter size a 2-inch and ½-inch drill as they should be ground by a well-designed machine, the complete conical surfaces and intersections being shown by fine lines. In these drills, the apices of the conical surfaces are moved away from the apex of the hollow cone a sufficient distance to produce, by the intersection of the surfaces, a proper form of chisel point; the axes are inclined so that the radius of curvature of the surface at the outer end of the cutting edge corresponds with that of the hollow cone; and these axes do not lie in the same plane but in parallel planes, at a distance apart greater than the thickness of the web of the drill, so

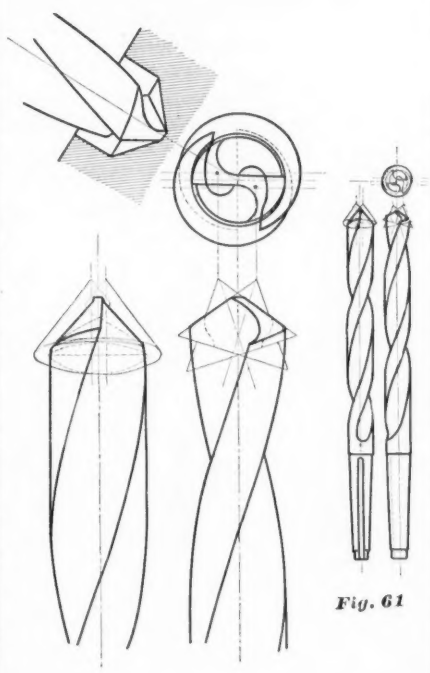


Fig. 61

that a tangent to the conical surface will make an angle of 5 degrees with a tangent to the hollow cone at the outer end of the cutting edge.

The shanks of twist drills are turned tapering, but unfortunately there has been no sensible standard adopted either for their diameters or the amount of taper. Each machine-tool builder has made the sockets in the spindles of drilling machines, lathes, etc., as circumstances or the fancy of the moment happened to suggest. The Morse Twist Drill Company established a standard, which has been adopted by most drill manufacturers and some tool builders, but, by some unaccountable perversity, the diameters are uneven and irregular, and each different size has a different taper. They also adopted, as a method of driving the drills, the use of a flat tongue, milled on the end of the shank and fitting in a slot across the bottom of the socket, which method has unfortunately been almost universally followed. This tongue frequently twists, its corners get rounded, and it injures the slot in the socket, soon rendering the latter useless. A far better device, to which the writer has been long accustomed, is a key fitted permanently into the socket and extending the entire depth of the latter. This key fits a groove in the shank of the drill and supplies a perfect means of driving the latter, with a minimum of wear and strain. The end of the shank, for a short distance, is turned smaller, and is hardened to prevent any upsetting by the use of the drift or wedge in removing the drill. The amount of taper, proper for the shanks, is a disputed question. The Morse taper averages less than $\frac{5}{8}$ inch in diameter per foot of length, or an included angle of about 2° 54′, but with drills driven by means of a key, $\frac{3}{4}$ inch per foot is better, as it enables the drills to be more readily removed from the socket, and at the same time prevents them from falling out by their own weight.

The following table gives the proportions of the Morse taper drill shanks. The diameter is measured at the mouth of the socket. The length is measured from this point, parallel with the axis, to the end of the shank. The taper is the amount of increase in the diameter per foot of length.

MORSE STANDARD DRILL-SHANKS

Diameter.	Length.	Taper.	Thickness of Tongue.
.475″	2.4 ″	604″	$\frac{1}{8}$″
.699″	2.86″	6 ″	$\frac{3}{16}$″
.936″	3 51″	601″	$\frac{1}{4}$″
1.231″	4 5 ″	.615″	$\frac{5}{16}$″
1.746″	5.76″	.625″	$\frac{3}{8}$″

The writer suggests the following as a table of standard proportions for the shanks of twist drills.

PROPOSED STANDARD DRILL-SHANKS.

Diameter.	Length.	Taper.	Thickness of key.
$\frac{1}{2}$ ″	$2\frac{1}{4}$″	$\frac{3}{4}$″	$\frac{3}{32}$″
$\frac{17}{32}$″	$2\frac{3}{4}$″	$\frac{3}{4}$″	$\frac{1}{8}$″
$\frac{15}{16}$″	$3\frac{1}{8}$″	$\frac{3}{4}$″	$\frac{3}{16}$″
1″	$4\frac{3}{8}$″	$\frac{3}{4}$″	$\frac{1}{4}$″
$1\frac{1}{4}$″	$5\frac{5}{8}$″	$\frac{3}{4}$″	$\frac{5}{16}$″
$1\frac{5}{8}$″	$6\frac{3}{4}$″	$\frac{3}{4}$″	$\frac{3}{8}$″
2″			

DISCOUSSION.

Mr. George R. Stetson, Superintendent of the Morse Twist Drill Co., said:

In the matter of the proper grinding of twist drills, the manufacturers are interested, as the one thing standing in the way of their more general use is the want of care in their grinding.

The common practice, among metal-workers, of grinding a tool where it is dull, without regard to the proper form, works badly for twist drills.

The larger proportion of drills returned cracked up the center and complained of as defective, are broken by not having the clearance back of the cutting-edge properly removed.

There are several machines now in use that secure automatically the proper angle and clearance.

Their prices range from $100 to $200, the makers not being able to furnish them for less. I would suggest that any one making a machine for $50 to $70 to grind drills from $\frac{1}{4}$″ to $1\frac{1}{2}$″; or, better still, from $\frac{1}{8}$″ to 2″, would be a public benefactor.

In hand-grinding, it takes but little practice to give the circular clearance. Rest the drill on the left hand and move the shank by the right hand.

The clearance can be measured by resting the drill point on a plain surface, and holding a common rule parallel with its sides and noting.

In a drill not much worn, the angle of 59 or 60 degrees, which forms the cutting lip, in combination with the angle of 27 degrees, which is the angle of the spiral at the point, will produce a straight cutting lip or edge. Any deviation in the angle of the cone or cutting lips produces a hooked or irregularly-formed cutting edge. These conditions change somewhat as the drill is worn towards the base, as the angle of the spiral changes.

To show that it pays to study to get the best results with drills, I give some figures furnished me by a superintendent of a works where drilling is an important feature. He writes: "I have drilled with one $\frac{5}{16}$″ drill 4,383 holes, each 2″ deep, in annealed cast iron. I drilled 1,200 pieces in one day, equaling 200 feet deep. The drill is running 1,000 revolutions per minute and feeding 6″ per minute. One thousand revolutions of a $\frac{5}{16}$″ drill gives about 82 feet per minute of speed at the periphery of the drill." I watched the working of a $\frac{3}{8}$″ inch drill in the same class of work. In this case the work revolved, the drill having only its forward or feed motion. The work made 528 revolutions per minute. Feed was 88 to the inch, and the work was drilled $4\frac{3}{4}$″ deep in 51 seconds, feed being 6″ per minute, and velocity of periphery of drill nearly 52 feet per minute. In both the above cases the cast iron was thoroughly annealed. The table of speeds of twist drills published by the Morse Company, gives about 20 feet per minute for iron. In a good quality of cast iron this could be 30 feet. On steel as usually annealed, 20 feet per minute is fast. Better results are obtained at 16 to 18 feet per minute. The conditions of stock vary so much that any table of speeds must be used with judgment.

Regarding the standard taper for the shanks of drills, the idea of Mr. Morse was to establish a standard taper of $\frac{5}{8}$″ to the foot. He commenced in a very limited way to make drills in Bridgewater in 1862, and did not secure the aid of capital until the summer of '64, when the Morse Twist Drill and Machine Company was formed and his works moved to New Bedford. The first set of hardened and ground standards were made in '72, and the original idea of $\frac{5}{8}$″ to the foot taper had been departed from or was not accurately established at first. The stock of drills in hand would have made it difficult to have made any change, and the error has been allowed to continue. The greatest deviation is in the No. 2 shank, and amounts to .025″ in a foot, or .0059 in the length of the shank. It would be much easier to correct this error than to establish a new standard. The objection to a sharper angle or taper is that the drill has a tendency to draw out of the socket when coming through its work. This twists the tongue and produces most of the trouble complained of, and would be best obviated by a taper less than $\frac{5}{8}$″ per foot. The Standard Tool Company, of Newark, established a standard of $\frac{9}{16}$″ taper per foot.

The desire to avoid the waste of stock required to make the taper shank to drills will ultimately lead to the more general use of straight-shanked drills and the chuck that will hold them strong and true, to get all the work out of the larger sizes of drills without their slipping, I would recommend as a secondary problem to the man who should succeed in making the ideal grinder for 50 dollars.

Gold Product of the World.

The value of the gold product in 1884 is placed at $93,000,000, and that of silver at $120,000,000. These figures mean little, except as taken in comparison with those of previous years. The value of the gold production is seen, however, to be 2 per cent. less than that for 1883; 9 per cent. less than that for 1882, and 13 per cent. less than that for 1881. Between 1851 and 1860 the annual yield was $134,000,000, or 30 per cent. more than that for the past year, and in the succeeding decade, 1861–1870, it was 25 per cent greater. Thus has the production decreased, not only since the golden period of 1850, but year by year since 1880. —*Bradstreet's.*

The Buffalo, New York and Philadelphia and Nickel Plate roads had a moving job on hand on Sunday last. The two companies wanted to move the station building from Earnham to Hamburg-on-the-Lake, a distance of fifteen miles, where the tracks run side by side. Early on Sunday morning a flat car was placed on each track, and the building was put upon them. Two engines running parallel with each other were attached to the cars, and together they drew the station to its new resting place, where it was unloaded and made ready for business Monday morning.—*Buffalo Express.*

Typographical Union No. 6, of New York City, will hold their annual ball at Tammany Hall, on December 4th, next, in aid of their general fund. They will doubtless have an enjoyable time.

Dickson's Expansion Packing Rings.

The engraving shows a packing-box in section, with these packing rings applied. The rings are made of anti-friction metal, and are put in the box in halves. As will be seen single V rings are used top and bottom, and a double V ring at center of length. It will be readily understood that, in screwing up the gland, the V rings strike the packing in the center expanding it each way against the walls of the box and the rod.

The manufacturers of this packing are Dickson Bros., Brooklyn, N. Y.

"Millwrights—Mechanical Engineers."

BY JAMES F. HOBART.

We don't hear much now-a-days from the good chaps they used to call millwrights They don't call themselves by that name now. They call themselves mechanical engineers.

We don't want to hear from the old millwright who could pare away half a day on two or three cogs of a mortise gear. We want to know about the boys who crawl into old wheel pits to replace a stick of timber which has rotted out, and then find that 8,000 or 10,000 feet of lumber are necessary before the job is completed.

We want to know more about the everyday men who are always ready with a way to get out of a difficulty, or to get up an improvement on a process, as a matter of course.

We have been down there, and have done our share of the dirty work, and the Sunday work, too. Let's be a good, honest millwright for a day or two. We get into a mill with all the machinery lying loose, steam-engine to be set, shafting to be put up, lines run, and all the responsibility to stand. Perhaps the masons have not run their lines and levels as well as they might. Probably the levels are a "bit" out, and a mason's "bit" is never less than 4½".

Then the carpenter's work has to be remedied. The carpenter always knows where a bolt-hole must come, and he always drives a 40-penny spike in the exact spot.

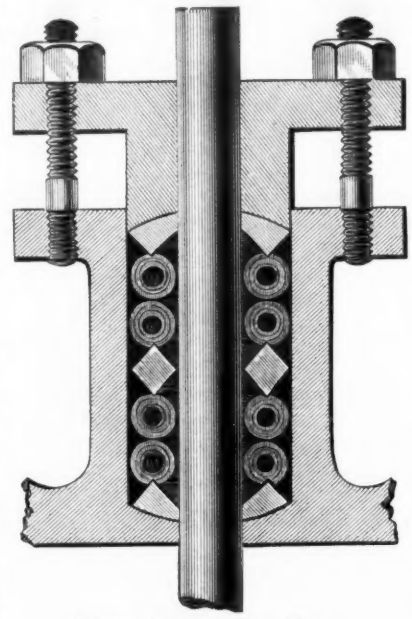
The millwright has got boxes to scrape, keys to refit, new key-seats to cut with cape chisel and hammer. All the machinery seems to be on raw edges when it first starts, and the millwright has to be on deck with wrench, oil-can and brains. *You* couldn't stand it to pay a good price for your work and have all these things adjusted in the shop where they ought to be done. No! You squeezed down the price to the lowest cent, and then got what the maker could give, while we poor millwrights have to stand in the breach.

After we get the work done, then comes the hardest job, and that is to get our pay. The machine man has been paid, and so have the carpenters and masons, and if there is any money left, the millwright stands a slight show of getting some—sometime.

Perhaps we have got a job in some big concern. We are expected to keep it running all the time, and never ask much material wherewith to repair. Perhaps we have got to make alterations, and work around and over barefaced death in the shape of running machinery.

We remember once putting in a friction-clutch pulley wherewith to work a 200 H.P. Porter-Allen engine with 500 H. P. water-wheels. Well, we put it in, and then we must devise means of working the clutch-pulley from the engine-room, 150 feet distant.

A screw was devised to work the clutch lever, and geared to a shaft to reach the engine-room. Three 24" brick walls, one 36" stone, and two wooden walls were the obstructions, to say nothing of total darkness, much water and dirt. The course of the shaft was not in line with the building. It was not level. There was no way of stretching a line, either in the rooms above, or beside the place. We figured it out "and then guessed at it." We dug holes through the walls and tried to draw a line, but could do nothing with it in the dark, and, by crawling over it, kept knocking it down. We got six petticoat lamps, and trimmed them to give nice little lights, about ½" long. We put one at each end of the shaft space, on wooden targets, and then had Mike juggle a lamp at the next bearing, until he got it exactly in line. Then he took the next lamp, and so on through the whole distance.



DICKSON'S EXPANSION RINGS.

We got that shaft in straight; built up the walls around pieces of pipe which were slipped over the shaft; got the clutch to running, and then were ready to "figure on a siphon condenser for our 200 H.P. engine, or to go to the wheel-pit and set up a water-wheel step, look after the oilers or set a new steam-boiler.

At any time the poor millwright must be ready to go up to the office and listen to six months' work which must be done before Saturday night, and to stand a genteel "sheoling" because Pat or Mike burned out a box, or smashed up an engine.

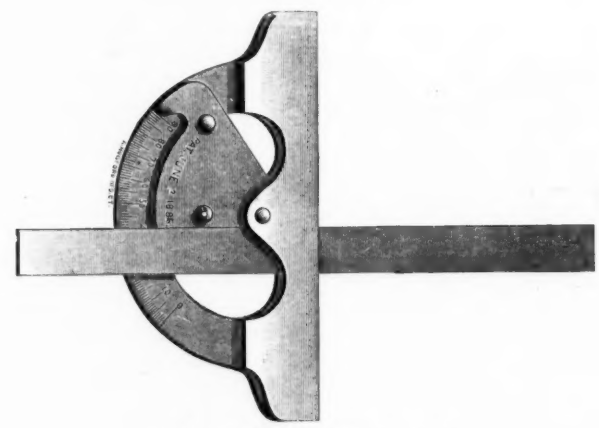
We can do this work 312 days per year and be a millwright, but the chap in tight pants, who carries an indicator-box in his hand, will kick like mischief if he hears anybody call us mechanical engineers.

The "Victor" Bevel Protractor.

This is a very convenient tool for machinists and tool-makers. The blade swings between the two working faces of the head or stock, and when clamped at any degree the angle may be set off to the right or left without further adjustment, by simply turning the tool over.

By means of the index point and divided quadrant, the blade may be set at any angle from 0 to 90°, and firmly clamped. The blade slides its full length on the working edge of the sector thus giving a long bearing surface and not liable to wear. The blade may also be drawn back, leaving the face of the head clear for use on surface plates and on platens of planers for setting the head at any angle—a very valuable feature. An extra blade, three inches long, brought to a point by beveling off one side at an angle of 30 degrees, is included with the tool, and is very convenient for inside dovetailing. Instead of setting the index point at the center of the division mark, this tool is adjusted so as to show the full size of the mark forward of the index. The quadrant is plainly and correctly divided to degrees.

This tool is made by the Victor Mfg. Co., Athol, Mass.



"VICTOR" BEVEL PROTRACTOR.

An Excellent Course of Scientific Lectures.

The Franklin Institute, of Philadelphia, has established a course of lectures which presents admirable features. Following is the course complete:

Nov. 2, Mr. R. D. Baker, of Philadelphia, *Introduction to Elementary Chemical Course.* (*Illus.*)

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Nov. 13, Lieut. Bradley A. Fiske, U. S. N., *Electricity in Warfare.*

Nov. 16, Mr. R D Baker, of Philadelphia, *Hydrogen, Chlorine, Oxygen and Laws of their Combination.* (*Illus.*)

Nov. 20, Mr. Coleman Sellers, Jr., with Wm. Sellers & Co., Philadelphia, *Oliver Evans and his Inventions.*

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Nov. 27, Lieut. John P. Finley, U. S. Signal Corps, Washington, D. C., *Tornado Study: Its Past, Present and Future.*

Nov. 30, Prof. Persifor Frazer, D. Sc., Franklin Institute, *Résumé and Conclusion.* (*Illus.*)

Dec. 4, Mr. A. H. Emery, of Stamford, Conn., *Testing Machines as Instruments of Precision.*

Dec. 7, Dr. N. A. Randolph, Biological Department, University of Pennsylvania, *Food.* (*Illus.*)

Dec. 11, Prof. A. E. Dolbear, Tuft's College, College Hill, Mass., *Telephone Systems.*

Dec. 14, Dr. N. A. Randolph, Biological Department, University of Pennsylvania, *Nutrition.* (*Illus.*)

Dec. 18, Wilfred Lewis, with Wm. Sellers & Co., Philadelphia, *The Mechanical Powers.*

Dec. 21, Dr. N. A. Randolph, Biological Department, University of Pennsylvania, *Digestion.* (*Illus.*)

Dec. 28, Dr. Wm. H. Wahl, Secretary of Franklin Institute, Philadelphia, *Water Gas.*

Jan. 4, Dr. Henry F. Formad, Biological Department, University of Pennsylvania, *Germs: Their Influence on Health.* (*Illus.*)

Jan. 8, Mr. M. N. Forney, late Editor R. R. Gazette, New York, *Evolution of the Locomotive.*

Jan. 11, Prof. S. P. Sadtler, University of Pennsylvania, *Coal Tar Distillation.*

Jan. 15, Col. Wm. Ludlow, Chief Engineer Water Department, Philadelphia, *Water Supplies of Cities.*

Jan. 18, Col. Geo. E. Waring, Jr., Sanitary Engineer, Newport, R. I., *Subject to be announced.*

Jan. 22, Mr. John Hartman, of Taws & Hartman, Philadelphia, *Subject to be announced.*

Jan. 25, Mr. C. J. Kintner, Chief Examiner, Department of Electricity, U. S. Patent Office, Washington, D C., *The United States Patent Office Historical Electrical Apparatus*

Jan. 29, Mr. Oberlin Smith, President Ferracute Machine Company, Bridgeton, N. J., *Flow of Sheet Metal in the Drawing Process.*

Feb. 1, James Christie, Pencoyd Iron Works, Philadelphia, *Elementary Problems of Bridge Construction.*

Feb. 5, Mr. T. C. Search, Textile Manufacturer, Philadelphia, *Technology of Worsted Manufacture.*

Feb. 8, Prof. M. B. Snyder, Central High School Philadelphia, *The Relations of Pure Research to the Electrical Exhibition.*

Feb. 12, Mr. Rudolph Hering, Sanitary Engineer, Philadelphia, *Sanitary Plumbing.*

Feb. 15, Mr. C. John Hexamer, *Petroleum, its History, Chemistry and Geology.*

Feb. 19, Prof. J. E. Denton, Stevens Institute of Technology, Hoboken, N. J., *Practical Example of the Laws of the Conservation of Energy.*

Feb. 26, Mr. C. John Hexamer, *Petroleum: How Obtained, Refined and Tested; Uses as an Illuminant.*

Mar. 1, Mr. Carl Hering, of Philadelphia, *Dynamo-Electric Machinery.*

Mar. 5, Mr. C. John Hexamer, *Petroleum: Products of Petroleum and their Uses in the Arts.*

Mar. 8, Mr. Carl Hering, of Philadelphia, *Dynamo-Electric Machinery.*

Mar. 12, Prof. Cleveland Abbe, U. S. Signal Office, Washington, D. C., *Signal Service Apparatus and Methods.*

Mar. 15, Capt. Otho Ernst Michaelis, U. S. A., *The Function of Electricity in the Development of Marksmanship; or, Electro-Ballistics.*

Mar. 19, Prof. De Volson Wood, Stevens Institute of Technology, Hoboken, N. J., *Subject to be announced.*

Manipulation of Steel and the Boiler of the Steam Barge B. W. Arnold, and the Behavior of the Steel Plates Used in Its Construction.

BY W. L. CLEMENTS, MECHANICAL ENGINEER, INDUSTRIAL WORKS, BAY CITY, MICH.

The sudden fracture of flanged steel boiler heads, also the peculiar action of high-grade steel when subjected to punching and forming, have formed an opinion of unreliability among steel users and boiler makers. The failures after manipulation in steel made by the best manufacturers and stamped, are quite frequent, and the pecuniary risk to which the manufacturer is subjected, the danger to life and property, of the user, have rendered it necessary that some of the causes of failure should be known.

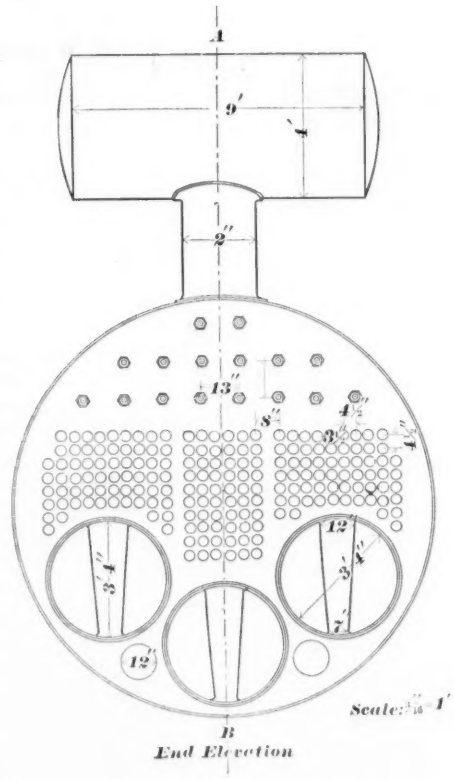
Figs. 1, 2 and 3 (page 5) show the action of steel plate improperly manipulated. Fig. 1 is a flanged boiler head, which, several days after flanging, upon accidentally falling on the ground, was fractured as shown. Fig. 2 is the lower portion of a crane jib, constructed of ⅝-inch steel, which, several weeks after being formed and riveted together, suddenly fractured. These were cases in practice. It may be remarked that the workmen employed in boiler works generally, are, as a rule, good operatives in iron plate, but have a great deal to learn in the manipulation of steel. There is no doubt that such accidents are caused by internal stresses set up in the plate by improper manipulation, for the fracture relieving the strain, the material is found to be ductile. With iron plate manipulation is easier and such accidents could not have occurred. The case of the Arnold's boiler is not a similar one, but the illustrations given show that local heating and manipulation may induce stresses, which endanger the entire structure.

The advantages in the use of steel for boilers, are manifest; its great strength, which allows a reduction of 25 per cent. in thickness from that required in iron, and allows an increase of over 30 per cent. in pressure, if the same thickness as of iron be used, and its ductility and durability. Its

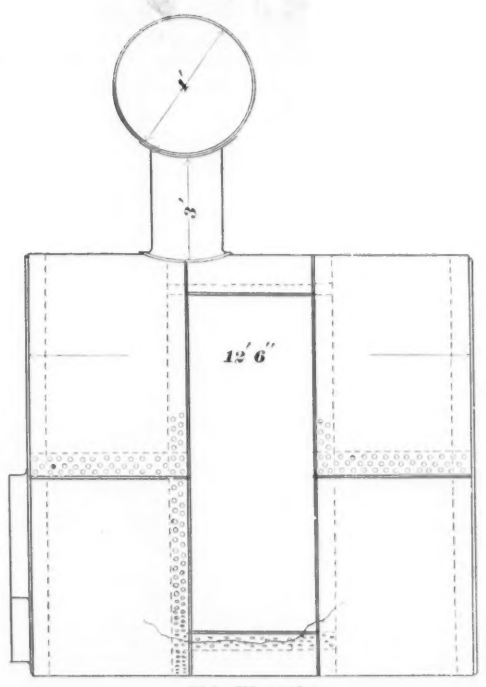
cheapness of late in the United States has brought it within reach of all manufacturers. Its merits are acknowledged, but until our workmen learn to manipulate steel properly, its use should be entered into with some hesitation.

The use of steel for marine and stationary boilers, was as prevalent in England eight years ago, as it is in Michigan to-day. In 1878 boilers were generally made of iron throughout the country. In the report of the English boiler surveyors, and in the experience of English users, we find that their old troubles are ours of to-day.

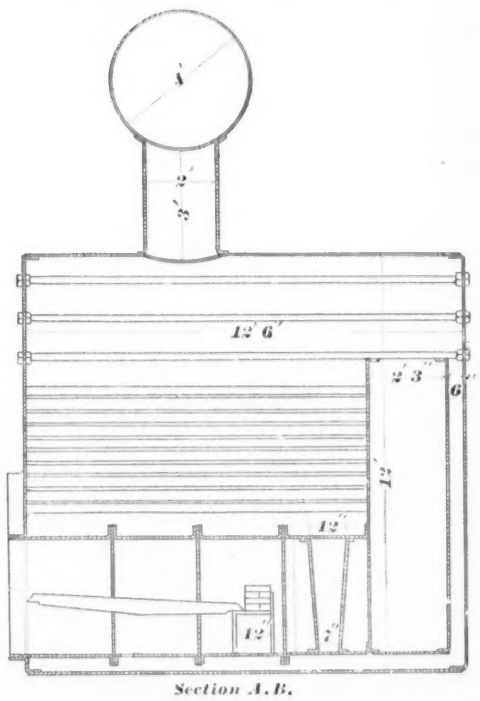
In the Arnold's boiler were used steel plates, stamped by a reputable steel maker, coupons all tested by the local boiler inspector, and in every requirement of law were found to be satisfactory. Yet the boiler gave way when its working pressure was but slightly passed. Similar cases have occurred, and more has been thought on the subject than published. It may be mentioned that the class of boilers now generally built on the lakes for marine work, is known as the "Scotch boiler," a type generally used at the shipyard of John Elder. The accompanying cut represents such a boiler as built for the steam barges Kittie M. Forbes, and the B. W. Arnold. The main difference being that in the Arnold the shell is constructed of $\frac{11}{16}$-inch steel, instead of $\frac{5}{8}$-inch steel, and the ultimate tensile strength reduced from 70,000 lbs. on the Forbes to 68,000 lbs. on the Arnold. Both were to be allowed 100 lbs. of steam per square inch working pressure. The shell is in three courses of plating, lap-jointed triple-riveted in the longitudinal seams, and double-riveted in the circumferential seams.



End Elevation



Side Elevation



Section A. B.

The Act of Congress relating to steam-boilers and inspection, requires this boiler to stand a hydrostatic pressure of 150 lbs. per square inch. In accordance with this, the test was prepared by local inspector Asa R. Cole, and at a hydrostatic pressure of about 121 lbs. per square inch, the boiler gave way with a fracture, as shown on the cut. It is probable that the fracture started in the second row of rivets, and extended either way as shown.

Several theories, more or less plausible, were hastily made as to the cause of the fracture, which assigned the trouble due to the improper position of the saddles, supporting the boilers, or to the pulsations of the steam-pump producing the pressure.

To the local inspectors and to others, it appeared that some cause, either in the quality of the steel, or in its manipulation, must account for the fracture. Accordingly samples were taken, as near the fracture as possible, the results of which are given.

TABLE I.

Thickness of samples expressed in hundredths of an inch	.68	.69	.69	.67	.69	.68	.68	.71	.68
Width of samples expressed in hundredths of an inch	.54	.62	.55	.65	.56	.60	.58	.48	.47
Strain at which each sample parted	25100	27850	27000	28500	25200	28200	26600	22200	23900
Strain per square inch of section	68955	65100	71146	65442	65217	69117	67444	65140	74780
Reduced width of sample	.39	.44	.41	.48	.39	.45	.41	.35	.55
Reduced thickness of sample	.47	.47	.49	.43	.45	.45	.44	.50	.50
Reduction of area per cent	50.08	51.65	47.06	52 60	54.58	50.36	54.25	48.65	45 24

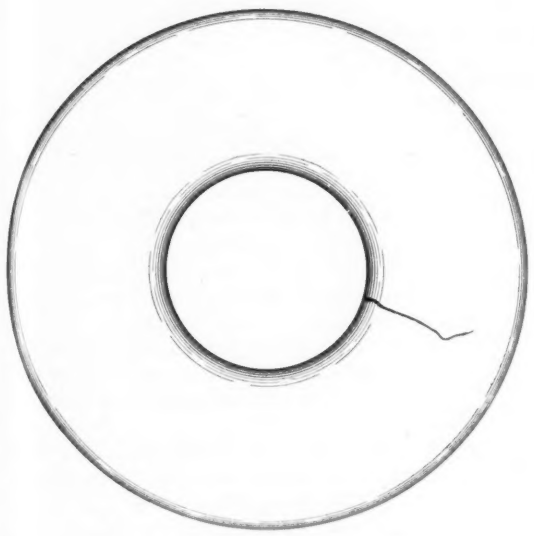


Fig. 1.

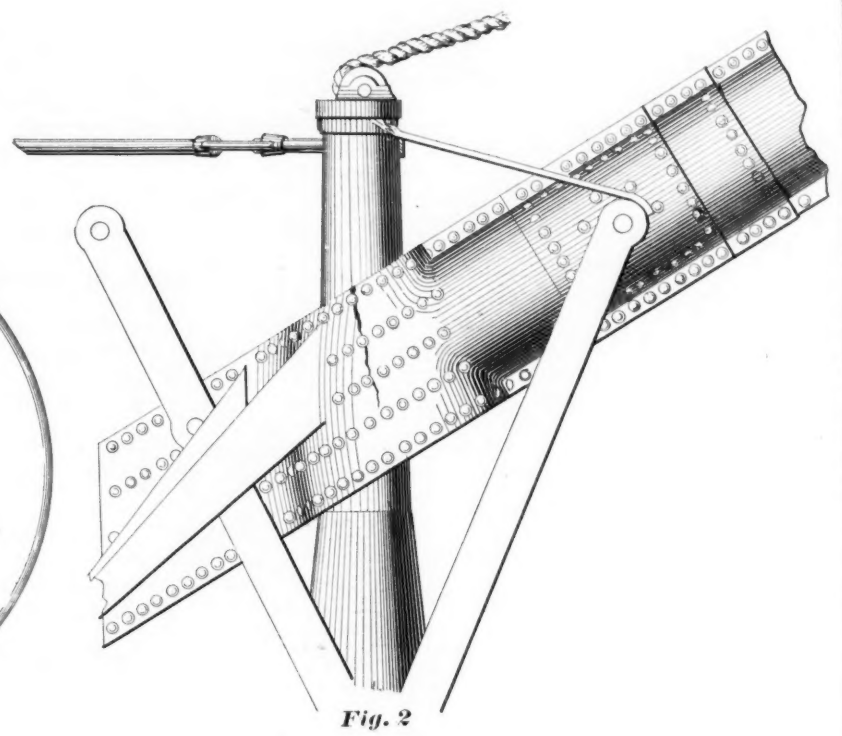


Fig. 2

TABLE II.

	No. 1.	No. 2.
Thickness of sample expressed in hundredths of an inch	.70	.72
Width of samples expressed in hundredths of an inch	.51	.51
Strain at which each sample parted	26400	26090
Strain per square inch of section	73949	70806
Reduced width of sample	.37	.39
Reduced thickness of sample	.52	.55
Reduction of area per cent	46.10	41.58

It will be seen from Table I., which shows the coupon test of the nine sheets used in the shell, that the ductility and tensile strength show a good grade of steel, having a mean tensile strength of 67,971 lbs. per square inch, and a mean reduction of area of 50.49 per cent.

Table II. shows the test of two pieces of the fractured sheet, taken as near as possible to the fracture. No. 2 sample is crosswise of the sheet. It will be seen that the tensile strength of the fractured plate is a little increased and its ductility decreased, a result which would indicate a slight temper formed.

Steel for boiler making purposes, should contain from one-quarter to one-third per cent. of carbon. Above these limits the material has a greater tensile strength, little ductility, is brittle, capable of taking a temper, and unsuitable for boiler plates. Below the limit, the material closely approaches wrought iron in its characteristics; it is ductile, easily welded and incapable of taking a temper.

The tensile strength of steel then, is dependent, roughly speaking, on the carbon it contains. There is a difference of opinion as to what the tensile strength and amount of carbon in steel for boilers should be. And it may be stated generally that the higher the tensile strength the more difficult the successful manipulation, consequently more appliances must be used, and greater care and attention must be bestowed with the workmanship.

The surveyors to Lloyd's Register require steel to have an ultimate tensile strength, between 26 and 30 tons per square inch, and consider it unsafe to use steel above 30 tons for boilers. It has been suggested that the steel contained an excessive amount of carbon, rendering it brittle and erratic. This would be a plausible theory were the plates one inch thick or over, for it has been shown that to keep the same ductility and tenacity in thick plates as in thin ones, the amount of carbon must be increased. But the plates in question are comparatively thin, and the amount of carbon as shown by the tests is not excessive. It may be mentioned that from the fact of the excessively large amount of carbon necessary in thick plates for a tensile strength of even 30 tons, it has been lately suggested by Lloyd's surveyors, that the tensile strength for thick plates, be lowered.

The facts that have an important relation to the case in question are embodied in a report made by Mr. W. Parker, chief surveyor to Lloyd's, and are as follows: "That thin steel plates lose comparatively little in punching, being for the one-quarter-inch plates, 8 per cent; for the $\frac{6}{16}$-inch plates, 8 per cent., and for the one-half-inch plate, 26 per cent., while in the thicker plates of $\frac{5}{8}$ inch, and $\frac{3}{4}$ inch, it reaches so high in some cases as 33 per cent., or one-third the strength of the plate. The experiments show that the injury is confined to a zone of metal round the hole less than one-eighth of an inch thick; for where $\frac{7}{8}$-inch holes were punched in $\frac{3}{4}$-inch plates, and then reamed out to $1\frac{1}{8}$ inch diameter, the material stood practically as high a tensile strength per square inch as the solid plate or the drilled plate had done. Reaming the holes out $\frac{1}{8}$ of an inch, then, restores the strength of the plate entirely. Another process is to anneal the plates after punching. In the specimens tested by us, when this was done, the punched and annealed plates, stood as high, and, in some cases higher tensile strain per square inch, than the solid plate, or drilled plate.

"These experiments show that in cases of marine boilers, the shell plates should be drilled in place, or if punched, they should be subsequently annealed, as has been required in the steel boilers, which have already received the sanction of the committee, and are now in course of construction." Lloyd's surveyors also reported that at some works the holes were drilled, at others punched, but in all cases in which they are punched, the plates are afterwards annealed.

The processes of manufacture in the Arnold's boiler were briefly these: In manip-

ulation the material was used as if it were iron. The plates were heated as evenly as possible, and rolled to the required curvature, placed in position, holes marked and the plates punched to the required size of the rivet. The boiler was then erected and the holes which were not fair were reamed. The plates were then riveted together by a power riveter. It will thus be seen that the operation so insisted on by Lloyd's surveyors, that of annealing after punching. shearing and bending, was not performed, and the boiler could not have been registered at Lloyd's, as the strength of the joint so formed would have been so reduced as to be unsafe.

As the boiler gave way at a hydrostatic pressure of 121 lbs. per square inch, the material endured a tensile strain of 11,027 lbs. per square inch, or about $\frac{1}{5}$ of its ultimate tensile strength. This is on the assumption that the percentage of strength for the plate and rivets at the joint are equal.

In consideration of the above facts, and the experienced authorities who have investigated the subject, it is correct to say that the accident to the Arnold's boiler was caused by improper manipulation of the material.

That is the operation of punching steel plates of a tensile strength of 68,000 lbs. and as thick as $\frac{11}{16}$ inch without subsequent annealing, so weakened the joint, as to cause the fracture, and the operation of bending, which was performed when the material was neither red hot nor cold but between these limits, which is acknowledged bad practice, lessened the ductility of the plate, as shown by the samples tested near the fracture, and gave it a slight temper.

Lloyd's requirements are briefly these :

1. The material must have an ultimate tensile strength of not less than 26 tons, nor more than 30 tons per square inch of section.

2. All holes must be drilled, or if punched the plates must be afterward annealed.

3. All plates, except those that are in compression that are dished or flanged or in any way worked in the fire, must be annealed after the operations are complete.

It has been remarked in the report on the effects of punching without annealing, that the loss of strength in the joint is comparatively low for plates $\frac{3}{8}$ inch and under, and increases rapidly above this thickness, and we are thereby assured of the safety of steel stationary boilers, for the thickness of the shells in their cases, rarely exceeds $\frac{3}{8}$ inch thick. But for boilers with thicker shells, and it is the tendency to use larger boilers with increased pressure, the above facts apply.

In conclusion, I quote the words of Mr. Adamson, who is the originator of the modern marine boiler, and whose fame has reached many engineers, in the success of the Adamson flue-joint, "that the strong metals that will carry the highest tensile strain, and possess great resisting power, must be carefully treated in manufacture, or the whole of its advantage may be turned to destruction. No violence is admissible and the action of punching in such cases, ought forever to be abandoned, and according to the writer's experience, punching at all times is a barbarous system of rude manufacture, that oftener than is suspected leads up to destruction."

Steam Engine Tests at the Massachusetts Institute of Technology.

The Massachusetts Institute of Technology has for some time been carrying on a series of steam-engine tests for the benefit of the students, the engines tested being those in use for driving the machinery belonging to the Institute. The results of these tests will, we presume, be made public from time to time, and will no doubt be of much value in the interests of steam engineering. Memoranda of some of these tests were presented at the recent meeting of the American Society of Mechanical Engineers. From these it appears that in tests of an $8'' \times 24''$ engine of the Corliss type at a piston speed of 240 to 280 feet, boiler pressure 60 to 70 lbs., the highest economy resulted from a cut-off at 45 per cent. of the stroke, about what might be expected from a small engine at slow piston speed.

In the paper as presented to the society, it is stated that there is shown "the curious fact that slow speeds show better economy at small powers than high speeds." It appears to us from a hasty examination of the tables that the difference in this respect is certainly no more, if indeed it is as much as would be expected. As, for instance, we note that in one case at a speed of the Corliss engine of $68\frac{1}{2}$ revolutions the indicated horse-power was only 1.78, and the water per horse-power 149 lbs., while in another instance the speed was 23 revolutions, the horse-power 1.56 and the water 87.5. As at this small power the difference in useless work done at 23 and at $68\frac{1}{2}$ revolutions, is, by comparison with the useful work, enormous in degree, there seems nothing strange in the fact that the difference in water required is large.

In the methods employed in these tests the difference between the water accounted for by the indicator at cut-off and at release is considered, and from this the water re-evaporated in the cylinder is deduced. The objection to this way of stating conclusions is, that any part of this difference may be due to leakage into the cylinder after cut-off. It has come to be very generally accepted that, while there is a good deal of re-evaporation, too much has been charged against it, and that generally leakage is responsible for considerable of the increase of steam present at release.

We understand that these tests are to be continued indefinitely; they will undoubtedly cover other interesting points.

LETTERS FROM PRACTICAL MEN.

Brass Furnaces.

Editor American Machinist:

The brass furnace illustrated in the AMERICAN MACHINIST of Oct. 31, 1885, is a good style, but there are some defects which at a trifling expense could be arranged to make the boy's heart glad who has to clean out and make ready. I place two bearing bars across the ash pit one inch below the lower ring of the furnace and about 8″ from the center of the furnace each way. On these I place loose grate bars $\frac{3}{4}''$ square, and about 26″ long, so that when I want to clean out the cinders and refuse I can take hold of the outer end of these bars and draw them out, when the furnace can be cleaned and the grates returned with great ease. These bars should be arranged about $\frac{1}{4}''$ apart; and the great advantage is that should you wish to clear the grates of ashes and cinders while the heat is in progress, you can take the poker and move the outer ends of the grates sideways, or knock them back and forth until they are entirely free.

I would not have the opening to the chimney more than 5″ square, for as soon as the heat is properly started, unless I am in a great hurry, I put a half fire-brick in the flue hole to keep the heat back in the furnace.

There is considerable to be saved in crucibles by making a nice soft heat with next to no draft, instead of that severe scorching heat that melts the crucible first and then the metal. It is entirely useless to make heat in such a furnace faster than it will pass through the walls of the crucible.

The right kind of a hook, I think, is a double one, which will take the tongs on each side of the rivet by that part of the jaws which is nearly horizontal between the rivet and the edge of the crucible.

This hook is made by taking a piece of $\frac{5}{8}''$ round iron and bending it in the middle over a 3″ bar, then bend this doubled end over a $1\frac{1}{2}''$ bar about 3″ from the doubled end; this is to hook over the bar, then at a suitable length from the last formed hook, say 10″ or 12″, turn a hook on each end over a 2″ bar, and have them far enough apart to hook one to each jaw of the tongs. This makes a very substantial arrangement and one that cannot be unhooked by accident.

In I firing I have the crucible stand on a half fire-brick if nothing better is at hand; put this on the grate bars first, then the kindling or coke or anthracite, enough to make a fire as deep as the crucible stand, and when this fuel is properly ignited, clear the fuel off the stand and set the crucible on it and cover it; then as soon as possible fill around the sides and up to the top of the crucible, take off the cover and fill up with metal, put on the cover and fill the furnace to the top of the flue hole. If you use an old crucible for a cover saw it off square and as short as possible.

When the heat is near the melting point, put a half fire-brick into the flue opening to check the draft, and as soon as the first metal is melted add more if there is more to go in. If you are mixing metals, do so as soon as the copper is melted, and stir frequently and allow it to stand in a fluid state as long as convenient, as many compositions of metal are poured that are not thoroughly mixed; this is an important fact overlooked by many.

It is best when zinc is to be added to copper to do so as soon as the copper is thoroughly melted. Take the zinc in the tongs and hold it over the copper, nearly touching the surface, until the zinc commences to melt, then plunge the zinc under the surface of the melted copper, stirring it about smartly until the zinc is all melted.

A. F. WARD.

Cleveland. O.

Power Required in a Paper Mill.

Editor American Machinist:

Having recently been engaged in placing an engine in the paper mill of the Winchester (Va.) Paper Company, and having obtained some data as to power required, etc. I thought it might be of interest to your readers. The engine is a "Westinghouse," 18″x16″ running at 250 revolutions, and guaranteed to develop 200 horse-power.

The mill contained two 170 horse-power Zell water-tube boilers, each having 100 tubes 4″ diameter by 16 feet long, for water surface, and five of the same dimensions for superheating, a mud drum, water drum, and steam drum. The grate for each boiler is 6 feet 6 in. by 7 feet, equal to 91 square feet under both boilers. The stack is 75 feet high, which gives ample draught, in fact, the damper, controlled by a steam regulator, is half closed nearly all the time.

The engine is connected direct to a line shaft about 50 feet long, from which five beaters are driven. Each beater has a capacity of 700 pounds of stock, and runs at the same speed as line shaft, 250 revolutions. The paper machine is a three-cylinder one, each cylinder 28″ diameter by 64″ long, and has 24 dryers.

The material manufactured is straw board of varying thickness, usually lined with white paper.

The engine running the paper machine is 11″ diameter by 20″ stroke, and runs from 90 to 130 revolutions per minute, while the speed of machine varies from 16 to 45 feet per minute, according to thickness of paper. This engine exhausts into the drying cylinders against a pressure of 20 pounds above the atmosphere, and as much more steam is supplied by the boilers as is necessary to keep up this pressure. The cooking house contains six tubs, each having a capacity of two tons of straw; the cooking is done with the exhaust steam from the Westinghouse engine. The steam pipe to this engine is 7″ diameter, and the exhaust pipe from engine to Stillwell heater is 7″ diameter also, but from heater to cooking tubs, a distance of about 70 feet, there is only a 5″ pipe, having a safety-valve near the heater to provide against an excessive back pressure; this is loaded to about 25 pounds, which is rather excessive.

An application of the indicator showed an average back pressure of 8 pounds in the engine cylinders, 7 pounds in the heater and 5 pounds in the pipe close to the tubs, or a loss of 2 pounds between heater and tubs.

As the engine was coupled to the shaft it could not be indicated alone.

The friction of engine, line shaft, and five beaters running light, was 65.3 horse-power.

The average power doing the regular work was 185 horse-power; the greatest power indicated was 195 horse-power.

$$\frac{195}{5} = 39 \text{ horse-power}$$

per beater.

$$\frac{185}{5} = 37 \text{ horse-power}$$

per beater, average power, including friction of all connections and engine.

$$\frac{185-65}{5} = 24 \text{ horse-power}$$

per beater actually used in beating straw.

They use 10 tons of bituminous coal per day of 24 hours, equal to 833 pounds per hour.

The amount of coal burned per horse-power could not be determined, as the steam for both engines, and for a variety of other purposes, was drawn from the same boilers. The combustion was 9.15 pounds per square foot of grate surface.

A. G. BROWN.

Plumbago for Cutting Bolts.

Editor American Machinist:

A small quantity of plumbago, thoroughly mixed in the oil used for cutting bolts and tapping nuts in the bolt-cutter, decreases the friction of taps and dies very materially.

CHARLES SMITH.

Reversing the Position of Air and Steam Cylinders of Locomotive Air Pumps.

Editor American Machinist:

There are two reasons why it would be better to place the steam cylinder *underneath* the air cylinder:

It would tend to equalize the up and down strokes of the pump, and prevent the condensed steam from passing through to the main air reservoir.

Any one who will give the matter a little attention will notice that the up stroke is much slower than the down stroke. There are two causes for this. The upward stroke has to contend with the weight of the piston, and back pressure on top of steam piston, from leakage of live steam from top cylinder-head around four or five movable parts of the valve motion, and the leakage is constantly getting worse as the parts wear.

This back pressure is easily detected by observing the excess of "blow" on the up stroke. Both of these conditions are wanting in the down stroke, and the weight of piston tends to accelerate its speed.

The water from condensation accumulates in bottom of steam cylinder around piston, and during the up stroke (if the packing in the stuffing-box is not tight, and it seldom is), it is forced out around the rod and runs down into stuffing-box of air cylinder, and when the motion is reversed the water is drawn down into the air cylinder by the partial vacuum formed by the downward stroke of the air piston and rests on its upper side, from whence it is discharged to the air reservoir, where it causes trouble by filling up the air space. Tallow is also carried along with the water, and gathers around and obstructs the air valves and passages, and prevents the pump from working well.

By reversing the position of the cylinders as indicated, these difficulties would be overcome. The leakage and back pressure from steam cylinder would be counteracted by the weight of piston instead of acting with it, and the reverse of the conditions with regard to the water of condensation would cause it to pass out through the drain cocks and exhaust pipe.

This arrangement could be accomplished without much change in the parts as they now exist.

HIRAM R. JONES.

South Pueblo, Col.

For some time past work has been stopped on the Manhattan Island side of the Second Avenue Elevated Railroad. In the meantime the river bulkhead, on this side, has been in dispute as to ownership between the road and city authorities, and at the present time is still held by the latter.

On the 17th inst., however, the Elevated Railroad put a large force of men at work, and indications are that a station of some proportions will be erected and a connection had with the bridge, which evidently means that residents north of the Harlem River will soon have the privilege of enjoying rapid transit. It is impossible to say what will be the outcome of the bulkhead difficulty.

The Stephens Fiber Machine.

A machine about 30 feet long and 8 feet high, now on exhibition at 454 Hamilton avenue, South Brooklyn, is the outcome of a process recently patented by L. G. Stephens, which embodies the results of many years' patient investigation of the various classes of fiber-producing plants, and the methods at present employed in separating the fibers from the accompanying pulpy, woody or gummy matters, and preparing them for use in the many branches of industry whose existence depends upon an adequate supply of these materials.

The subject is one of such importance that many leading Governments have offered premiums for any machine or process which will utilize the enormous quantities of fibrous material now growing to waste in their different territories, particularly in the regions of the tropics.

The fiber question, to a greater or less extent, embraces almost all the arts, its direct application ranging all the way from rope and twine-making, and through the many textile manufactures, down to the making of paper and paper pulp.

Mr. Stephens' process has extreme simplicity as one of its greatest merits. All fibers, at some stage in the process of manufacture, are subjected to a combing or carding process, but Mr. Stephens makes this the main feature in the primary operation of extracting the fiber from the plant, thus dispensing with all the various scraping and scutching operations, which are now almost universally adopted, and which are, at their best, only instrumental in producing a very inferior and partially-cleaned article, flat in staple, and gritty, with dried, gummy matter left adhering to the fiber, and requiring subsequent treatment by several successive cleaning processes before it is fit to be converted into rope, twine or yarn.

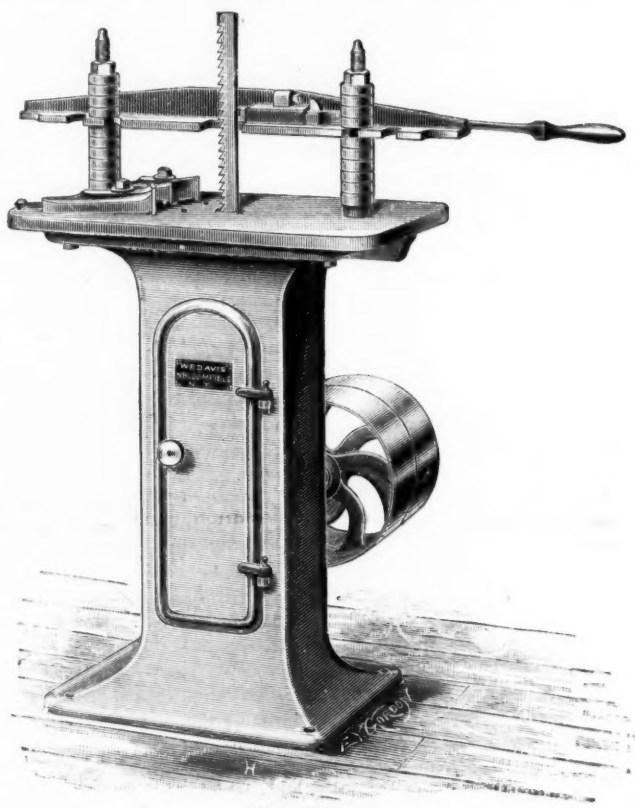
The new machine, as at present constructed, is more especially intended to work on "sisal" and the various other fleshy plants of the argave species, but it is equally well adapted to the separation of banana and manila fibers, and it also, with some slight modifications, works successfully upon hemp, jute, ramie, all the yucca, bromelia and dracæna species, and recent trials indicate that it may supersede the old-fashioned and somewhat rude method of preparing flax.

The plants above enumerated embrace those with leaves and stalks of almost all lengths, from about eighteen inches to ten and even fifteen feet long, and yet comparatively little difficulty has been experienced in adapting Mr. Stephens' process to the requirements of all of them, it being, of course, desirable, in constructing machines, to make the diameter of the carding cylinder proportionate to the length of the article to be treated, and also to adapt the character of the pins to the requirements of the various fibers.

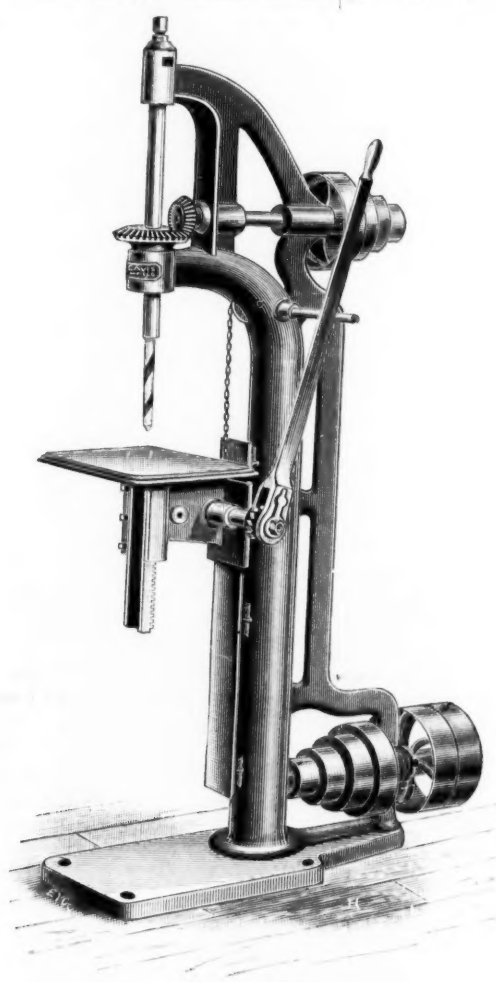
The novelty and main feature of the machine is the passing of the leaves or stalks laterally along the descending side of a carding drum or cylinder, the leaves being held firmly by their butt ends between grips or jaws, forming a portion of a continuous chain, or rather pair of chains, and extending the whole length of the cylinder. The jaws slide in grooves facing one another, and are maintained in close contact by springs, so as to form a continuous traveling vise. In the sisal machine now on exhibition, the process is also extended to the reversing of the ends of the leaves or stalks under treatment, so that the leaf is first grasped by the butt end and carried along the cylinder until the main portion is cleaned from the point up; and then, by an automatic attachment, the jaws open slightly, and, without any check to the continuous action of the machine, the uncleaned end is drawn through sufficiently to allow the jaws to close again upon the already-cleaned fiber, the butt end, in its turn, falling upon the cylinder, and being passed along it until clean, the whole leaf being finally delivered at the end of the machine perfectly clean, the fibers being straight, round and silky-looking — very much like a bunch of white horse hair combed out straight. When in full operation, the machine throws out a continuous stream of these bunches, hanging over an endless rope which can be arranged to convey them in any direction, and to any reasonable distance, so that they can be delivered, if desired, direct to the baling press. The capacity of the machine is limited only by the ability of the men in charge to supply it with raw material, which they simply lay flat on a feed-table at the entering end of the machine.

D. E. Thebaud, of Thebaud Bros., New York, associated with Mr. Stephens in the enterprise, has long been on the look-out for a suitable machine to supersede the extremely crude and wasteful process at present in vogue in Mexico for cleaning sisal. During the past summer a number of the Mexican sisal planters, and also some of the largest rope manufacturers, have witnessed the operation of the machine, and given it their unqualified indorsement.

The machine has been constructed under the supervision of Frank Darkin, known to our readers in connection with the Colt disk engine.



KEY-SEATER.



LEVER DRILL.

Lever Drill—Key-seating Machine.

We show with this engraving of two machines, made by W. P. Davis, North Bloomfield, N. Y.

The lever drill is intended to fill the demand for a machine of moderate cost when a good deal of the work it is intended for is required. The spindle is of steel, $1\frac{5}{16}$ inch diameter, fitted for Morse taper No. 2. The gears are cut from the solid, proportioned two to one; cone has four changes; drive pulleys, 10 inches diameter, $2\frac{1}{2}$ inches face.

The frame of key-seater is of one piece together with the ways; this secures strength and continuation of alignment. The connecting rod is so arranged as to keep chips and dirt from falling into the crank-pin. The ways are bored out and top of frame faced by putting frame on a mandrel and facing up top of column in lathe; the top is planed on both sides and by this arrangement every part is brought true. The saw clamp requires but a very short time to change cutters. The stud pins to clamp are provided with washers and so arranged that the clamp can be placed between them at any height required and will not drop down. A very simple arrangement is also furnished to give any desired draft to key seat required, also any depth, and every one can be made the same. The pulleys are 13 inches in diameter and $4\frac{1}{2}$ inches in face, and should make 60 revolutions per minute. This machine will cut from $\frac{1}{4}$-inch to $\frac{3}{8}$-inch key seats. Each machine is furnished with $\frac{1}{4}$-inch and $\frac{3}{8}$-inch cutters.

English journals argue that steel sleepers will soon supersede all others in Britain. But they are not happy, because English companies are placing large orders in Belgium. As a coercive measure, they propose that British manufacturers shall refuse to ship goods over railroads placing foreign orders.

In his excellent lecture before the Franklin Institute (a large part of which we published last week) Coleman Sellers said:

"Cable railroads have been in use in many cities for some years, their construction was experimental, and their present economy is problematical. I am not prepared to say just how scientifically they have been constructed in Chicago and the far West, but here in our own city we are seeing a gigantic constructive experiment tried on the cut-and-try principle. Metallic conduits for the traction cable are put into place over miles of roads, the conduits being so formed as to have little or no power of resistance against the crush of the frozen ground, and even so made as to present a shape most favorable to permitting the pavement to wedge the grip-slot shut. Wheels are put in to guide the ropes, seemingly without any regard to strains that might have been known beforehand; or, if not known, should have been found out by careful experiment, and the citizens, who should be using the streets to their best profit and convenience, are kept off them by a constant succession of changes, involving tearing up, altering, replacing to the discomfort of our fellow-citizens, and to the loss of the company owning the road. The public are less interested if this cut-and-try system is taking place in the private workshops, and the public cares very little about the stages of progress through which any finished product has passed in reaching the stage of use to the consumer. The public are warranted, however, in objecting to unsystematic and ill-advised engineering enterprises being conducted to their detriment and delay. There will be no end, however, to just such empirical engineering. The desire to save in the first cost, without considering the after result of such false economy, will be the rule perhaps for a longer time in the future than any one here is interested in, but it is the outgrowth of much evil in the methods of our schools. One of the first objects of education is, I think, to quicken the perception, to teach the habit of observing phenomena clearly and quickly, to instil the desire to trace effects to their causes and to cultivate close and just reflection. The elements of geometry, physics and mechanics should have the preference over many of the traditional studies of the primary and the grammar schools, and what is more, the early introduction of such studies, presented to a child's mind in a practical form, as they can be, will prepare his mind for the more extended study of the higher branches of the same subjects in later years. As it is, the alphabet of science is not taught until the student is ready to read the subject in later life, when he should have grown up with a feeling that he always was, in a measure, familiar with the facts of the science."

The *Railroad Gazette* of Nov. 13th has information of the laying of 25 miles of new railroad track making 2,283 miles laid so far this year against 3,246 miles for the same period last year, and 5,410 miles for a like part of 1883.

F. M. Wilder, Superintendent of Motive Power of the New York, Lake Erie & Western Railroad has resigned to accept the position of superintendent of the Corliss Steam Engine Works, Providence, R. I.

In a self-lubricating loose pulley, by Charles Hammelmann, of Buffalo, the arms are made hollow, forming chambers for holding oil.

Mr. Joseph Morgan, Jr., of the Cambridge Iron Works, said recently to the Congressional Ordnance Committee, that he believed the best of armor plates would soon be produced by presses and not by rolling.

The Board of Education of the city of Lockport, N. Y., will have mechanical drawing taught in the evening school of that city this winter. Classes in book-keeping and mechanical drawing will be instructed on Wednesday evenings.

The first quarterly report of the Brooklyn Elevated Railway Company shows an income of $94,824 35, and expenditure amounting to $79,399 14. The railroad was not completed to the Fulton Ferry until after the close of the quarter. It is now doing better than before, although it does not run through the principal business portion of the city. The fare is five cents at all hours of the day or night. The company owning this small elevated road in Brooklyn are so well pleased with its success thus far that they are trying to get the right of way to build two more lines in that city. We are told, however, that the New York elevated roads cannot afford to run for five-cent fares at all hours.

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NEW YORK, DECEMBER 5, 1885.

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National and Local Encouragement to Manufacturers.

Within the last few months, the anxiety of the people in hundreds of cities and towns in this country, to secure the location of new manufacturing establishments has increased to such an extent that unusual inducements have been offered the projectors of such enterprises to build in certain places. Building sites, water privileges, building materials, exemption from taxes, subscriptions to stock, and direct presents of money have been freely offered by the people of many towns to draw manufacturing establishments within their borders. Why have these valuable gifts been offered, and why are they being offered in greater profusion, even in dull times, with the cry of over-production echoing throughout the land? Those tendering the gifts have no expectation of being employed in the manufactories, and with the exception of parties subscribing to stock, they have no pecuniary interest in the profits to be made. The benefit they derive is indirect, but none the less substantial. Manufactories increase the prosperity of every kind of business in the localities where they are conducted. They put money into circulation, which goes into every avenue of local trade. Farmers, merchants and professional men share in the benefits, and they believe it to be a wise policy to extend substantial aid to the enterprises that can produce such results. The contrast between the prosperity of towns that have thus encouraged manufactures and those that would offer no inducements to secure them, is evidence of the wisdom of that liberal policy.

But there is a sect of political economists in this country who labor to convince the people that manufactures are a benefit only to those directly engaged in them, and that substantial encouragement to that branch of business on the part of the whole community is not justifiable. They are called Free-Traders, and a week or two ago some of the leading lights of that sect held a convention in Chicago. David A. Wells was president of the convention, and in his address he said:

According to the census of 1880, 17,392,000 persons in the United States were engaged in gainful occupations. Of this number, 44 per cent. were engaged directly in agriculture. Now, no man can name as large a proportion as 5 per cent. of the product of our agriculture that would be in any way injuriously exposed to foreign competition if every tariff law and every custom-house were to-day to be abolished. We import some sugar, a little rice and flax and some wool. But we export all our other agricultural products, the resultant of high wages, year in and year out, in defiance of the world's competition. Then 40 per cent. more of this grand total of workers were engaged in 1880 in professional and personal services, or in trade or transportation, none of whom can be protected by a tariff, leaving only about 16 per cent., who could, with the utmost latitude, be considered as engaged in manufacturing, and of these a careful analysis shows that not over 837,000, or less than one-twentieth of the whole number of workers in the United States, could be injuriously affected by any competition of laborers in other countries, even if there were no duties on foreign imports. In short, when we apply to the tariff the test of a scientific enumeration of people of this country according to their occupations, the assertion that protection protects American industry vanishes into the thinnest of thin air.

Herein we see the doctrine advanced that manufacturing industries are beneficial only to those engaged in them, and that the other and larger portion of the people are disassociated from any participation in the pecuniary advantges they confer. Mr. Wells professes to believe that those engaged in manufactures could be injuriously affected by a bad tariff without detriment to the remainder of the community. If his doctrine—or rather the Free Trade doctrine—is correct, the people who are giving liberal bonuses to secure new manufactories in so many different places, must be exceedingly foolish and the spread of such ideas viewed from a Free Trade standpoint must be absolutely alarming. Every one of those towns that has experienced the benefits of local encouragement to manufacturing establishments is becoming more convinced of the advantages of a protective tariff that builds up and proves a safeguard to the general manufacturing industries of the country.

If the Free Traders want to strike at the root instead of hacking at the branches they might better employ the $20,000 they decided to raise at the Chicago Convention in trying to counteract the local protective sentiment that is gaining wherever manufactures are located or propose to locate, instead of spending it in efforts to elect Free Trade members of Congress next fall.

Dauphine S. Hines.

After several years of failing health, the subject of this sketch died at his home, No. 72 Second Place, Brooklyn, N. Y., on Tuesday, November 10, 1885. Born at Stillwater, N. Y., January 28, 1829, Mr. Hines was therefore 56 years of age at the time of his death.

On the death of his father in 1835, the family removed from Stillwater to Rhode Island, locating at Lonsdale. Young Dauphine worked in the Lonsdale cotton factories more or less continuously for several years. Later on he attended school at Fruit Hill, R. I., for nine months, and this short term comprised the only opportunity he ever had to attend school. From an early age he was especially fond of mathematical studies, and was a diligent student in that direction, though with but scanty opportunities of indulging his tastes.

Entering the large shop of Thomas Hill in Providence (then and now building cotton machinery), young Hines learned the machinist trade, distinguishing himself, among other ways, by mathematically demonstrating the incorrect inclination of the cone then used on the spindles manufactured by Mr. Hill. After some examination of the subject, his views were adopted, and embodied in practical results. In 1849, at the age of 20, young Hines came to Williamsburgh (now a part of Brooklyn), and obtained employment as a working machinist in the shop of Worthington & Baker, then building the Worthington pumps. He remained with Worthington & Baker about four or five years, working part of the time in the shop under a foreman, and part of the time on ocean steamship work outside the shop.

On the removal of Henry R. Worthington to the present "Hydraulic Works" in South Brooklyn, in 1854, Mr. Hines took charge of the office, drafting room, and buying department, becoming within two or three years, general manager and superintendent, which position he occupied up to the time his health began to fail in 1880.

In 1865 he entered into partnership with Mr. Worthington and W. A. Perry, the firm retaining the same title, Henry R. Worthington.

That partnership being dissolved in 1880 by the death of Mr. Worthington, a new partnership was formed, under the same title, by Mr. Hines, Mr. Perry and Charles C. Worthington, a son of Henry R. Worthington, though for the past three or four years failing health has prevented Mr. Hines from taking any active part in the business.

Mr. Hines was one of the thirty engineers who took part in organizing the American Society of Mechanical Engineers at the preliminary meeting held in the office of the AMERICAN MACHINIST, February 16, 1880.

Possessed of a remarkable memory, he was a persistent reader, being especially familiar with a wide range of literature, including poetry, of which he was notably fond. He was also an expert microscopist.

While usually reserved in manner, of a peculiar gravity of demeanor, and a man whose words were few, but always to the point, Mr. Hines was fond of a joke, and very social and agreeable among those who knew him intimately. That to be just was a ruling trait of his character, is attested by the fact, that during all the 30 years he was manager of the Hydraulic Works, a large number of workmen, foremen and others, found continuous and pleasant employment under his direction. Of a generous disposition, he was unostentatious, helpful, and retiring. He well deserved the title of self-made man. He leaves a widow but no children.

If excessive railroad freights are a serious trouble to manufacturing establishments in a small country like England, what must they be in a country spreading over such a territory as the United States? One of our English exchanges notes the fact that the Nettlefolds have decided to remove from works that cost them $400,000 only twelve years ago, and build an entire new plant on the seaboard. Their railroad freights on manufactured iron and steel goods and raw material have become so burdensome as to cause this change. Petitions for reductions were all in vain. They expect to save $75,000 a year on freights alone, which the railroads will lose. The example is a very good one for some railroad companies in this country to contemplate.

Fink Still At It.

We have late advices to the effect that Fink, of bogus lubricator fame, is at his old tricks again in Iowa, being heard of at Ottumwa, the other day. His mixture costs, he says, 5 cents per gallon, and by mixing two gallons of it with one gallon of good oil, the result is three gallons of lubricant that will do as well as three gallons of oil, for which interesting piece of information we suppose he exacts a handsome bonus, as of yore, though we notice his later figures are much reduced from those in vogue before our exposures of his humbugging transactions appeared.

Our Hawkeye friends would do well to overhaul their files of the AMERICAN MACHINIST, and learn from the issues of March 22, April 12, May 10, July 12, and December 27, 1884, just how many thousand per cent. Fink's selling "prices" are in excess of the real value of his "lubricant."

The recent annual meeting of the American Society of Mechanical Engineers in Boston, was not only unusually well attended but successful in bringing out an improved grade of papers and valuable discussions thereupon. In no city where the society has heretofore held its meetings, has it been received with more courtesies than in Boston. These courtesies began immediately upon assembling, and continued until the close of the last session. The city government, the local committee, various local associations, and the citizens generally did all they could to make the visit of members entertaining and agreeable. President Holloway signalized the close of his term by delivering a pleasant address, and additions to the membership were made, bringing the total up to over 600. The society is in a flourishing condition.

The industrial census of Massachusetts taken this year ought to be an interesting study when completed. Manufacturers are required to answer a lot of questions in a circular, under penalty of $100 fine for refusal to answer any one of them. They must give total cost of materials for a specified quantity of product, amount of credit capital employed, amounts paid for freight on materials, cost of materials, and length of credit obtained on purchase of stock. If correct answers are given to all questions of this kind, they will be a great assistance to parties starting new enterprises, and not a little advantage to competitors in same line of business.

The cotton gin manufacturers of this country representing over $21,000,000 recently held a convention and decided to abandon the long credit system which has made the business hazardous. It was unanimously agreed to make all sales of cotton gins, feeders and condensers payable during the season in which the sales are made. This a good move. Long credits are not beneficial to trade.

William H. Guild.

William H. Guild, of the firm of Guild & Garrison, Brooklyn, N. Y., steam pump manufacturers, died on Wednesday, November 11, 1885. His age was 53 years. Mr. Guild was born in Connecticut, and came to Brooklyn when he was 16 years of age. He learned the trade of machinist as connected with the manufacture of steam pumps, and upon the death of his father, who was originally associated with Mr. Garrison in the business, he became his successor. He had greatly endeared himself to a large circle of co-workers, by his ability as a mechanic, his uprightness as a man, and his cordial disposition as a friend.

We learn that Prof. John E. Sweet has had an earnest invitation to return to his old position in Cornell University, since the retirement of President White. Having built up a solid and permanent business with his Straight Line Engine, it did not take the Professor a moment to decide not to accept the invitation.

The notes of discussions of papers read at the meeting of the Mechanical Engineers' Society, in Boston, which we publish, were taken by our special stenographer. We regret that the limits of our space, and the length of several of the papers, will not allow us to publish them entire.

The era of electric lighting is responsible for a prefix to the names of a good many articles. We have electric-light engines, electric-light belts, electric-light oil, and various other electric-light articles. It is probable if these are good enough to be used in electric-light plants, they may answer for other purposes where the conditions are not too exacting.

Literary Notes.

THE SUBURBAN COTTAGE, ITS DESIGN AND Construction. By W. B. Tuthill, A. M., Architect, Author of "Practical Lessons in Architectural Drawing," and Editor of "Interiors and Interior Details." New York: Wm. C. Comstock, 6 Astor Place. 100 pages, cloth, price, $1.50.

This work sketches a single plan for a country house of a certain size and cost, and following out the plan through all the details of construction, should supply useful information to families proposing to build in that way.

The *Stationary Engineer*, Vol. 1, No. 1, hails from Chicago. It is published monthly by the Engineers' Company at $1 a year. The first number is neatly gotten up, and contains considerable matter of interest to engineers, including quite an amount of correspondence and information about the Engineers' National Association. In the introductory they say:

"While the Marine and Locomotive Engineers have had journals devoted to their special interests, the Stationary Engineers have, for years, been dependent upon crumbs dropped from the Power User's table. While we have no word of disparagement for the many useful journals that are so well conducted, there is a great need for one that shall devote more space to the wants of Steam Makers."

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(333) F. L. R., Brooklyn, N. Y., will find books on drawing that treat on Perspective in the store of any publisher of books on applied science or architecture.

(334) W. R., St. Louis, Mo., writes: 1. I would like to know the proper location of gauge-cocks on a boiler? *A.*—It depends upon the kind of boiler, and its size. No general rule can be given. 2. If water comes out of the pet cock of a pump what is the trouble? *A.*—If the pet cock is properly located, water will come from it when the pump is working.

(335) J. S., Portsmouth, Va., asks: 1. How is the steaming capacity of a boiler with natural draft found? *A.*—The steaming capacity of any boiler is found by experiment only. 2. What volume of steam is raised from a given volume of water? *A.*—That depends upon the pressure. tA a pressure of one atmosphere the volume of steam is between 1,600 and 1,700 times greater than that of the water from which it is generated. At higher pressure the relative volume of steam decreases. See steam tables in any work on steam engineering.

(336) S F.B., Hornellsville, N.Y., writes: We use four boilers and a 20"×24" engine. The engine is overloaded. Would it be good economy to put another engine by the side of this, with the same cylinder capacity, coupled to one shaft and connected at right angles, or would it be better to put in a larger engine to do all the work? *A.*—Generally speaking, it is better economy to put in a new engine large enough for the work. There are, however, sometimes conditions where it is better to put in the second engine. It is good policy, in such a case as you present, to consult some reputable engineer, who, from an examination of your engine and all the circumstances, will be able to advise you as to the best course.

(337) J. H., Winona, Minn., writes: 1. A steam pump with water cylinder 5" diameter, at 200 feet per minute, will discharge about 200 gallons of water. How much larger should the discharge-pipe be to discharge 400 gals. in same time? *A.*—Twice the area. 2. Fire steamers are listed to discharge 400 gallons from one cylinder 5"x8". I had supposed that water could not be pumped fast enough for this. *A.*—The pumps of fire engines are especially arranged for the purpose, and do not run continuously, hence they can be run under conditions that would not be advisable in any pump designed for ordinary constant practice. 3 What would be the greatest difficulty in running at 300 or 400 feet? *A.*—The shock due to the piston striking anything so solid as water. If the pump does not fill, the piston strikes the water about like striking solid iron.

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

T. M. Parker, Steel Stamps, Stencils, Hart'f'd, Ct.

J. Clayton, Air Compressors, Rock Drills. 43 Dey st, NY

Edw. Sears, wood engraver, 48 Beekman st., N.Y.

Steel Name Stamps, &c. J.B. Roney, Lynn, Mass.

Tack, Wire, and Shoe Nail Machinery; Wm. A. Sweetser, Brockton, Mass.

Steel shank, wire nail, shoe nail and tack machinery. Keith & Trufant, Campello, Mass.

Tack and Wire Nail Machinery, made by the Willets Mfg. Co., Providence, R. I.

The Best Upright Hammers run by belt are made by W P. Duncan & Co., Bellefonte, Pa.

R Dudgeon, 24 Columbia st, New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts, New York.

Patent attorney and expert. Machine designs and details. Wm. H. Weightman, 82 Astor House, N.Y.

Foot-Power Machinery for workshop use, sent on trial if desired. W. F. & Jno. Barnes, Rockford, Ill.

Lyman's Gear Chart. How to lay out gear teet Price, 50c. E. Lyman, C E., New Haven, Conn.

Drop presses, and other special tools, manufactured by Williams, White & Co, Moline, Ill.

Improved Labor-Saving Upright Drills. 20 in. to 36 in. inclusive. Currier & Snyder, Worcester, Mass.

Selden Packing for stuffing box, with or without rubber core Randolph Brandt, 38 Cortlandt st., N.Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See Nov 7 p. 14. Send for circular No. 17, Curtis Reg. Co., Boston, Mass.

Files recut without drawing temper, about one-half usual prices; samples recut free; prices on application. The Acme Co, Collinsville, Conn.

The outline ("wax process") engravings shown in the AM. MACHINIST each week are made by Struthers, Servoss & Co., 24 to 34 New Chambers St., N.Y.

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-Taught;" $4. Books for workmen. Joshua Rose, Box 3306, New York City.

Screw oiler, for chairs or stools; pat June 16, '85; will sell Western, Southern, and Pacific States; address L. Postawka & Co, Cambridgeport, Mass.

Locomotive Engine Running and Management. By Angus Sinclair. Gives full directions about handling and repairing locomotives; instructs how to design valve gear and set valves; Westinghouse air brake explained by aid of engravings. Price, $2. For sale by *National Car Builder*, 187 Dearborn st., Chicago, Ill.

Every young man who aspires to be either a mechanic, merchant, or manufacturer, owes it to himself that he become thoroughly familiar with the writings of Chordal. John Wiley & Sons, 15 Astor Place, N. Y., have issued a new and enlarged 12 mo edition of "Extracts from Chordal's Letters." Handsomely bound in cloth, with over 50 illustrations. Price, $2. Discount of 25 per cent. on orders for five or more copies

Manufactures

S. S. Ward and others will start a machine shop at Eufaula, Ala.

D. J. Nysewander, Owosso, Mich., will build a pump factory.

E. F. McGee, West Point, Ga., will start a carriage and buggy manufactory.

Newton Phelps is about to erect a steam saw-mill at Camden, N. Y. Cost, $12,000.

The Aurora Cotton Mill, Asheboro, N. C., will add 650 spindles and 100 looms.

The Lickdale Iron Co. are putting in the Clapp-Griffiths process at Lebanon, Pa.

The J. T. & K. W. Railroad will erect a round-house and repair shops at Sanford, Fla.

The Pittsburgh Novelty Works will erect a factory at Rochester, Pa., to make novelties.

The German-American Brewing Co., of Buffalo, a new corporation, will erect a $150,000 brewery.

All the nail and iron mills in Wencham, Mass., are running on full hours for the first time in two years.

The city of Belfast, Me., will erect new water-works there next year, at a probable cost of $75,000.

F. W. Mertens, 134 E. 76th street, New York, will erect a five-story factory 25x100 feet, to cost $20,000.

The Columbia Steel Works have purchased a site for their new plant at Nine Mile Run, near Pittsburgh.

The Wilmington, N. C., cotton mills, which have for several months been closed, will start up in a few days.

John Clarke, 675 Willoughby avenue, Brooklyn, N. Y., will build a three-story factory, 40x60 feet, to cost $4,500.

Charles Schmidt, 9 and 11 Norfolk street, New York, will erect a five-story factory 25x40 feet, to cost $15,000.

The J. B. Aldrich Co. has been chartered at Memphis, Tenn., to manufacture sewing machines and attachments.

The Wampum Wire Co., Limited, Wampum, Pa., are contemplating the erection of a factory at New Castle, Pa.

The Lochiel Rolling Mill, at Harrisburg, Pa., has been leased by parties from Danville, Pa., and will soon be started up.

The Woonsocket Electric Light and Power Co., Woonsocket, R. I., has purchased ground for the erection of buildings.

Brockway & Monghan, Dover, Maine, will soon fit up a building in that town to be used for a blacksmith and machine shop.

The Gress Lumber Co. has been incorporated at Eastman, Ga., with $75,000 capital. G. V. Gress and others, incorporators.

A company, with capital stock of $25,000, will be incorporated at Albany, Texas, to build a mill and gin. $20,000 has been raised.

Hall's Engineering Co., 112 John street, New York, are receiving quite a number of orders for Hall's injector from the South.

A four-story mat factory, to cost $15,000, will be erected by the Greenland Mat Factory Co., at the foot of Gold street, Brooklyn, N. Y.

The woolen mill at Mechanicsville, Conn., is to be enlarged by the addition of 100 feet. The new addition will be two stories in height.

The Holland Mill, at Madisonville, Ky., will be supplied with new machinery of the improved patent process. New engines will be required.

The Wentworth Manufacturing Co., Boston, Mass., has brought out a new emery grinder. The claim for it is better protection of journals.

Walter Pierce is president and John Perry secretary of a new company that will erect a shoe factory to employ 40 or 50 hands, at Sharpsville, Pa.

The Georgia Pine Manufacturers' Association has been incorporated at Eastman, Ga. Capital $300,000. Harris & Mitchell and others, incorporators.

The contracts have been signed for the building of a shoe factory at Henniker, N. H., which will be 135 feet long, 35 feet wide, and three stories in height.

The Kenwood Felt Mills, Kenwood, Albany, N.Y., have purchased six acres of land at Greenbush, on which they will erect a three-story building, 60x200 feet, next spring.

Harry Darlington, 1st ave., Pittsburgh, Pa., and a company of Eastern gentlemen propose fitting up the old Eagle Cotton Mills, Allegheny, Pa., to manufacture toys.

Coyne & Delaney, 145 Mulberry street, New York, will erect a foundry and machine shop on Frost street near Union avenue, Brooklyn. It will be 25x50 feet, two stories high.

The *Western Manufacturer*, of Chicago, says it is reported that a number of Cincinnati manufacturers will remove to the former city after January 1, 1886. The reason is not given.

The Sterling Foundry Company, of Greenwich, Conn., has been incorporated. Capital stock, $12,000. Henry Webb, Wm. S. Reynolds, R H. Horne, and R. J. Walsh, incorporators.

Megguier & Jones, Portland, Maine, are to erect a new iron foundry this fall at the corner of Pearl street and Ashland avenue. It will be 75 feet square, and three stories high.

The New Process Twist Drill Company, of Taunton, Mass., have leased buildings, and will put in engine, boiler and machinery for making twist drills. Edwin O. Williams is superintendent.

Daniel T. Kelly, Portland, Me., will erect a wooden building, 85x40 and three stories high, on Kennebec street, in Portland, to be fitted up with machinery for the manufacture of agricultural implements.

A large coke blast-furnace is about to be built in the vicinity of Bellefonte, Pa. Among those concerned in it are General Beaver, Robert and George Valentine, D. G. Bush and Wm. P. Duncan. The capital stock will be $1,000,000.

Henry G. Thompson & Co., 51 Leonard street, New York, manufacturers of flexible-back steel hack saws for machinists' use, write us: "Our progress has been very encouraging, and we look for a good trade this coming season."

Prentice Bros., manufacturers of machine tools, Worcester, Mass., have moved into a new shop 210 x55 feet, two stories high. They have a good demand for their lathes and drills, and will soon issue a catalogue showing some patterns.

Water-works to cost $2,000,000 are to be erected at Syracuse, N. Y. Four pumping engines will be located at Oneida Lake, and the water will be forced through a cast-iron pipe to the lower surface of Syracuse Four pumps will be located in Syracuse to supply the higher surface.

Owing to the shutting down of Western nail mills, pending the settlement of the wages question, nails have become scarce, and the price has advanced. Eastern nail mills are taking advantage of the situation to do a rushing business. One mill recently had to decline an order for 50,000 kegs.

About $40,000 of the $50,000 to be raised in Taunton, Mass., for the new silver-plating company to be located there, has already been assured. Several workmen from there have already gone to work in the company's works at Shelburne Falls, and will re-locate in Taunton when the concern moves in the spring.

The Otis Iron and Steel Co. has ordered four Westinghouse engines of 200, 35, 25, and 8 horse power, respectively. This is the tenth order received from the Otis Co. within three years. The 200 horse-power engine is 18x36 inches, and will be coupled directly to a train of rolls making 300 revolutions.

Capitalists have, during the past year, invested some $25,000 in the purchase of lands and buildings at Rumford Falls, Me., on the Androscoggin, besides expending about $2,500 in a survey of the water-power. This means the establishment of some kind of a big manufacturing enterprise at an early day.—*Industrial Journal*

When American establishments can furnish locomotives in Australia for $2,000 each less than the price at which work not so satisfactory can be obtained in England, and in a much shorter time, as was recently done, our manufacturers certainly ought to be encouraged to compete actively for business in that great continent.—*Railway News.*

The Buster Mfg. Co. have purchased a piece of land on Preble avenue, Allegheny City, Pa, 200 feet wide, and extending back to the Ohio river, on which they will immediately erect a building 100x175 feet, to be used as a foundry and finishing shop. They have promised to place $75,000 worth of machinery, and employ a large number of men.

The City Council of Hannibal, Mo., have ordered an election to be held December 1, at which the citizens shall say whether or not bonds to the amount of $20,000 shall be issued for the purpose of putting in an electric-light plant, to be owned and operated by the city. This is a sensible move. Water and illumination in a city should be owned and supplied by the people themselves.

The Chicago *Industrial World* says: "The new factory building of the Crane Brothers Manufacturing Company will be ready for occupancy in about two weeks. It is to be used exclusively for elevator building, and will be fitted with new machinery and employ about 200 men The old machine shop is to be divided up and used for the manufacture of wrought-iron goods. This concern is turning out more goods than at any time during its history."

The Lyman mills corporation have decided to give the weekly payment system of Holyoke, Mass., a fair trial, beginning January 1, and if it works well they will probably adopt it. They employ 1,300 hands, 300 men and 1,000 women, and the monthly pay-roll is $28,600. The directors of the Washington & Moen Manufacturing Company, of Worcester, have voted to adopt the weekly payment system after January 1. They employ about 3,000 hands.

The Water Commissioners of South Abington, Mass., are investigating schemes for a water supply.

The Board of Public Works of Jersey City, N. J., are in the market for 6″ and 8″ cast iron water pipe.

The Superintendent of Water-Works of Minneapolis, Minn., has the placing of orders for 6″, 8″, 10″ and 12″ cast-iron water-pipe.

The firm of J. H. Williams & Co., consisting of James H. Williams, Matthew Diamond, and Wm. H. Brock, has been dissolved, and a new co-partnership formed, successors thereto consisting of James H. Williams and William Brock, who will continue the manufacture of drop forgings at 15 Richards street, Brooklyn, N. Y.

The citizens of Scottdale, Pa., held a very enthusiastic meeting on October 30, at which upward of $6,000 was subscribed for the erection of a new skelp mill. William H. Everson and C. L. Graff, of the firm of William H. Everson & Co., owning the Scottdale Rolling Mill, and who will erect the new works, were present, and gave a written guarantee that the firm would not start a company store, nor use undue influence with the employes to deal at any store or stores in the town. They propose to establish a cash system, and, of course, the business men responded heartily to the call for subscriptions, and the mill will be erected.

Machinists' Supplies and Iron.

NEW YORK, Nov. 19, 1885.

Dealers and manufacturers are disposed to be impatient at the slow improvement of business, but, on the whole, there is reason, if not to be satisfied, at least to be gratified, that what change there is, is in the right direction.

Iron—In American pig the demand is principally for small lots, but the number of orders keeps stock in the better brands low, and the market firm. We quote No. 1 X Foundry, $18 to $18.50; No. 2 X Foundry, $16 to $16.50; Grey Forge, $14.50 to $15.50.

Scotch Pig—There is little call for Scotch brands, and prices are only fairly steady at: Coltness $19.50 to $20; Glengarnock, $18.50 to $19; Gartsherrie, $19 to $19.50; Summerlee, $19 to $19.50; Eglinton, $17.50 to $18; Langloan, $19.50; Dalmellington, $18 to $18.50.

Lead—Car lots have sold at 4.20c., but there is little demand. Buyers and sellers do not meet on price.

Copper—The market is uneventful, but there is an inclination towards a slight advance in prices. We quote Lake 11c.; other brands, 10c.

Tin—The demand is small, and considerable effort is required to maintain prices. Jobbing lots of Banca have sold at 20½c.; Straits and Malacca, 20.30c.

Spelter—Refined, 5¾c. to 6c.

Antimony—Hallett's, 8½c.; Cookson's, 9½c.

WANTED

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Situation as foreman of machine shop; good references given. Address Buckeye, AM. MACHINIST.

Situation as foreman or supt. of machine shop; good references. Address R., AM. MACHINIST.

A first-class machinist desires situation; prefer to go South. Address J. W., P. O. Box 64, Pittsfield, Mass.

Competent mechanical draftsman wants position in office, or as assistant to superintendent. Address Active, AM. MACHINIST.

Situation by foreman machinist on agricultural implements or machinery; well acquainted with improved methods of getting out work cheaply. Address B. B., AM. MACHINIST.

Wanted—By practical mechanic, designer and draftsman, position as supt. or foreman of machine works; have had large experience handling men and systematizing work; best reference given; corresp'ce solicited. Address Box 486, Waterbury, Ct.

Wanted—Situation as foreman boilermaker, by a practical boilermaker, 39 years of age; 25 years' experience; 9 years as foreman, locomotive boilers, tanks, tubular boilers, flue boilers, etc.; knows how to take care of tools, and work them and men to their full capacity; best refs. Address P. B., AM. MACHINIST.

MISCELLANEOUS WANTS

Advertisements will be inserted under this head at 35 cents per line, each insertion.

The Cyclone Steam Flue Cleaner has no equal. Crescent Mfg. Co., Cleveland, Ohio.

Wanted—Patented articles to manufacture and introduce. Box 88, Newark, N. J.

To make room for larger tool, will sell cheap, for cash, a planer 42″x42″x12′, in good order. Address, P. O. Box 2085, Bridgeport, Conn.

Wanted—A good second-hand 60″ lathe, to take 16′ between centers. Address, with particulars, A. B. Bowman, 1101 N. 2d st., St. Louis, Mo.

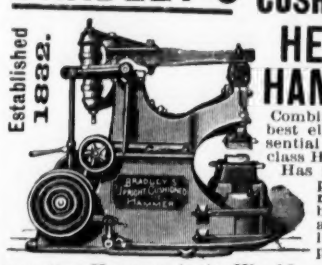
Special mch's. for any kind of mfg. designed to order. Also plain and autom'c eng's. Send for circular and refs. Weston & Smith, Syracuse, N. Y.

Gun Machinery—For sale, a shop containing a full equipment of machine and special tools, patterns and patents required for making a well-introduced shot-gun. For particulars, address S. O. Randall, 70 Weybosset st., Providence, R. I.

CHANDLER & FARQUHAR,
177 & 179 Washington St.,
BOSTON, MASS.

TOOLS AND SUPPLIES
—FOR—
Machinists, Plumbers, Gas Fitters, Electricians, Model Makers, Roller Skate Makers, Amateurs, etc.
Send for Catalogue B.

BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER
Established 1832.



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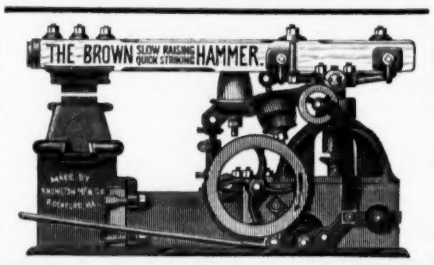

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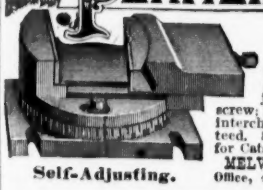

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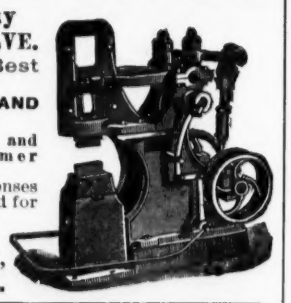

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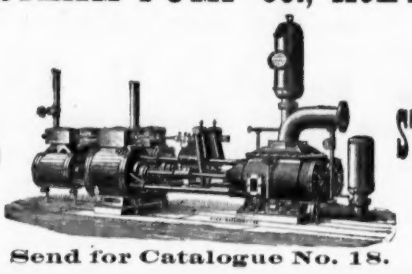

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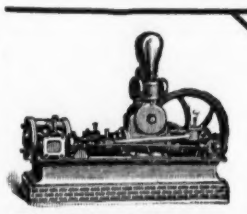

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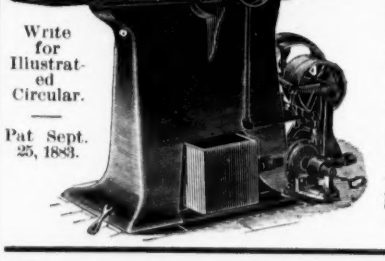

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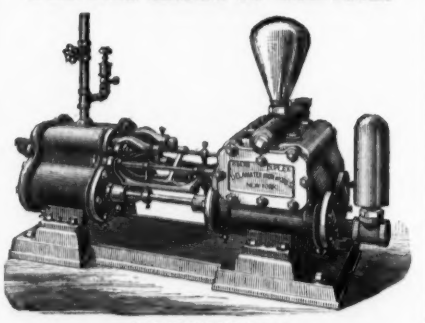

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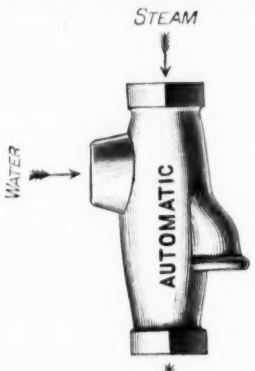

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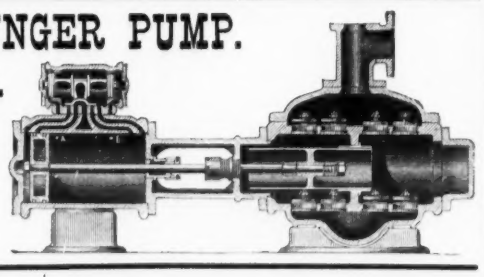

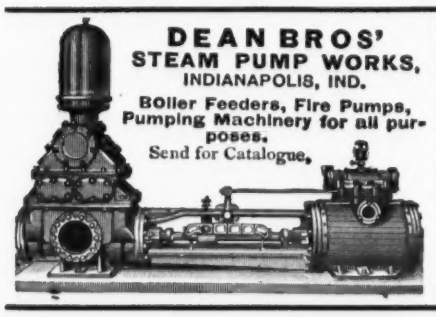

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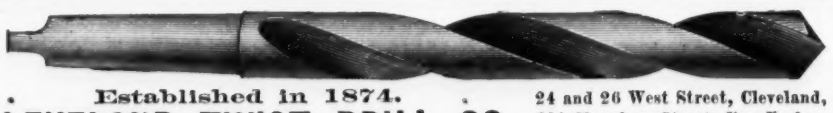

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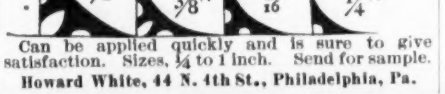

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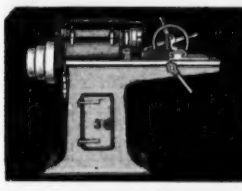

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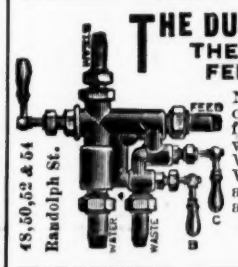

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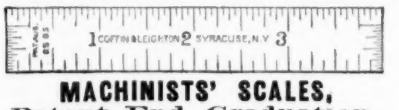

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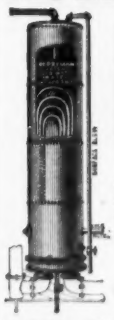

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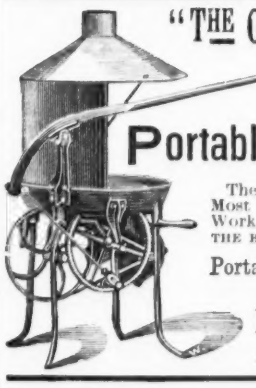

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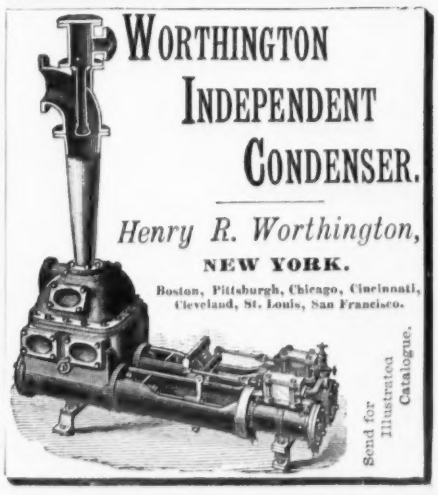

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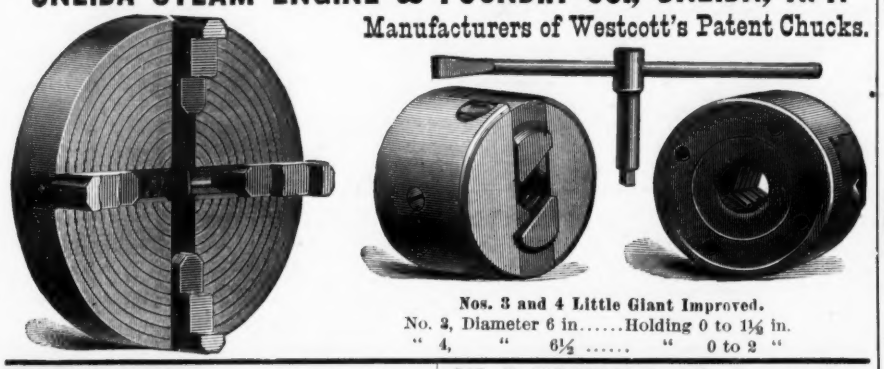

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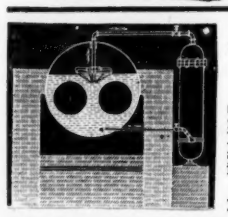

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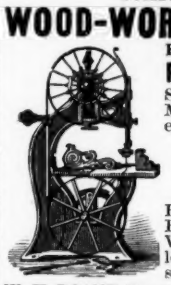

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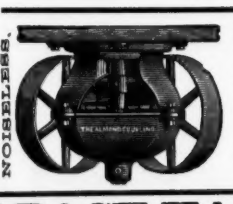

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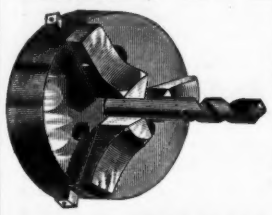

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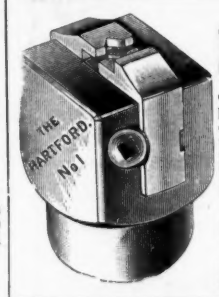

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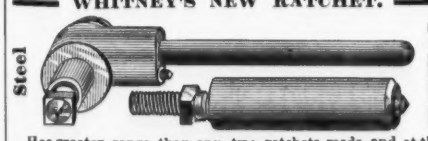

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Week before last we published, under this heading, references to a small portion of the practical articles that have been specially prepared for the AMERICAN MACHINIST, and have appeared in our columns during the last few months. Last week we published an additional list. We append another list below. No other mechanical journal in this country has or ever has had such a collection of practical articles, by writers of well known ability, as are presented in these columns week by week. Every issue gives information that is taken up and applied in the shops and factories in various parts of the country. Copies containing these articles can be readily obtained by ordering of any newsdealer, or by writing to this office, at 5 cents per copy.

F. G. Woodward.
A Primitive Electro-Magnet Engine. Aug. 22, 188
Car Transit by Endless Cable. Feb. 28, 1885.
How to Clean Foul Pipes. Dec. 6, 1884.
How to Originate a Scale of Equal Parts. Sept. 6, 1884.

Wm. H. Harrison.
The Development of the Connecting Rod. Sept. 5, 1885.
Balancing Revolving Bodies. March 21, 1885.

John A. Caldwell.
Blue Lines on White Ground. May 2, 1885.

Geo. B. Grant.
Pitch of Worm Gears. May 23, 1885.

J. A. Hill.
Oiling Locomotive Valve Motion. May 23, June 27, 1885.

Benj. F. Hetherington.
Casting Rolls on a Shaft. May 23, 1885.
Cleaning Boiler Tubes. June 14, 1884.
Boiler Makers and Boiler Buyers' Methods. April 25, 1885.

Wm. Hultgran.
Foundry Foremen's Blunders. Jan. 24, 1885.
Shrinkage of Castings. May 23, 1885.

W. W. Hanscom.
Cable Railway Transit. July 26, 1884; March 28, 1888

John Snow.
Reducing the Face of Spur Gears in the Mould. Feb. 28, 1885.

Geo. O. Vair.
Moulding Potash Kettles in Green Sand. Feb. 14, 1885.
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The Bourdon Pressure-Gauge Tube. Jan. 31, 1885

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A Method of Nickel Plating. Aug. 16, 1884.

John Coffin.
The Balance of Rotary Parts of Machinery. Jan. 17, May 16, 1885.

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Piston-Rod and Valve-Stem Packing. April 25, 1885

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The Use of Zinc in Boilers. July 5, 1884.
Cylinder Oils — Economical Size for Engines. April 25, 1885.
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Machine-Shop Floors. Dec. 6, 1884.

James W. See.
The Safety Element. Nov. 1, 1884.

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Milling Machine Cutters for Double Duty. June 28, 1884.

David Spence.
Charging Cupolas. April 5, 1884
Tinning Wrought Iron. June 20, 1885

A. H. Mathesius.
Power Needed in Operating the Cable Road on Brooklyn Bridge. January 3, 1885

Jno. C. Trautwine, Jr.
What Is Centrifugal Force? April 5, 1884
Centrifugal Force, a Component of Tangential Tendency. April 26, 1884
Nature of Centrifugal Force. May 17, 1884

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On the Warping and Cracking of Castings. July 18, 1885.

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Richmond & Danville R. R. Co.'s Cast Iron Smoke Stack. August 1, 1885.

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Ed. F. Williams.
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Inertia in its Nature and Means of Measurement. August 23, 1884
Inertia Diagram. October 18, November 1 and 22, 1884; January 3, 1885

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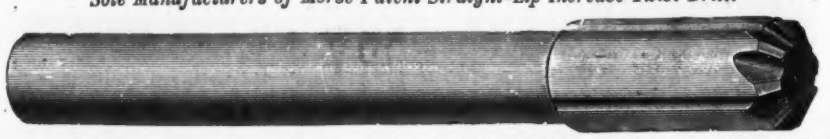

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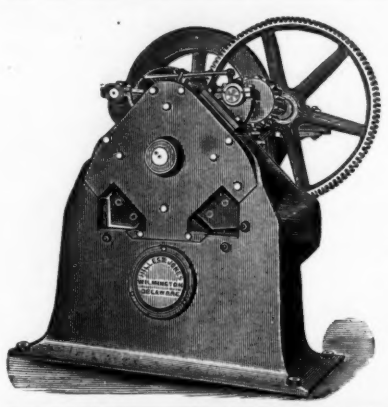

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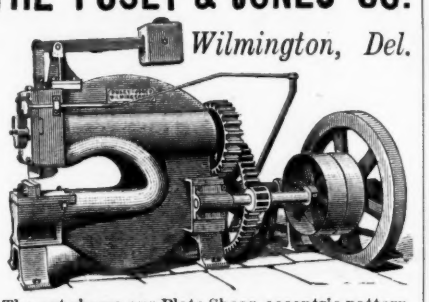

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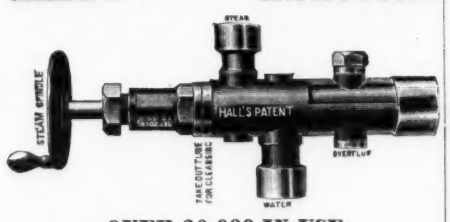

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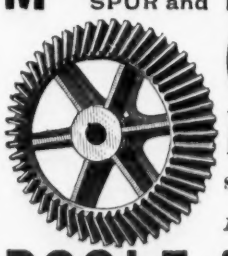

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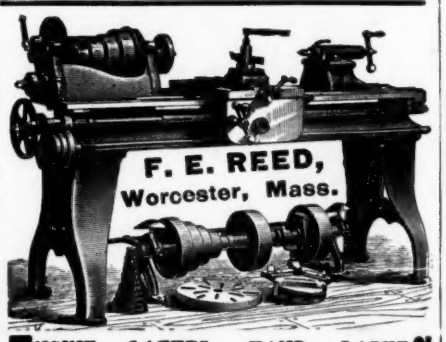

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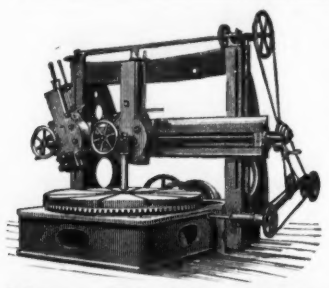

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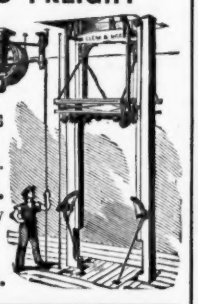

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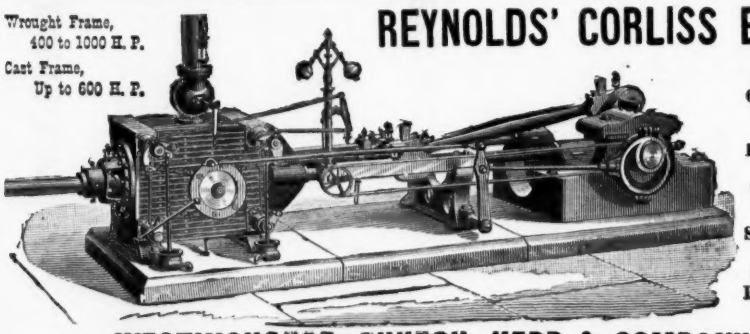

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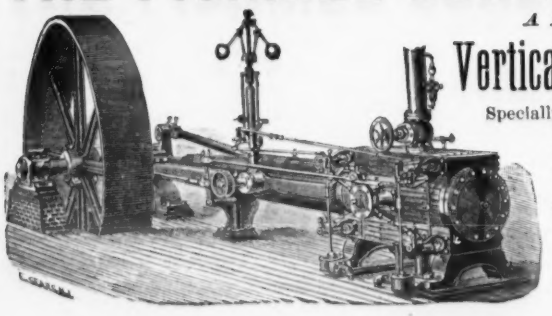

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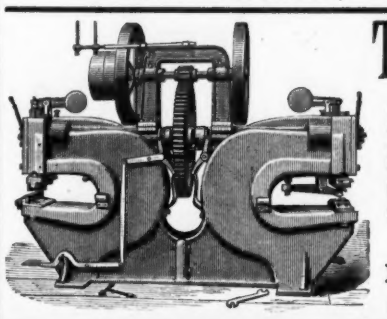

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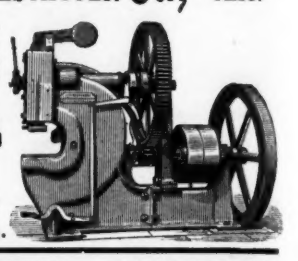

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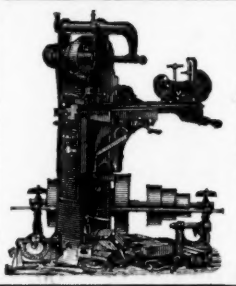

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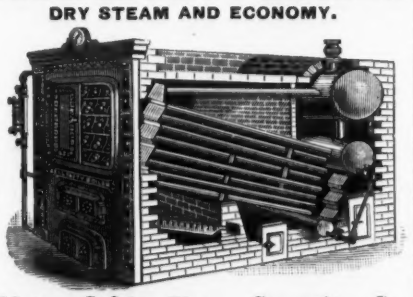

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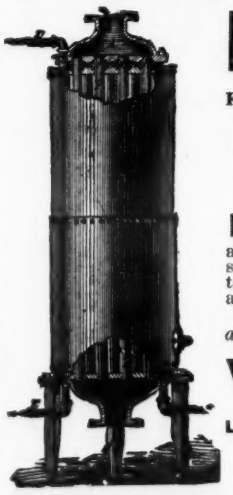

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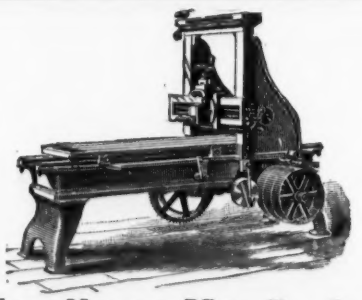

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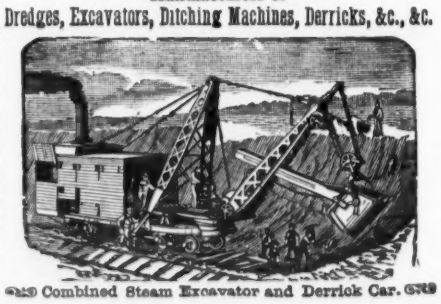

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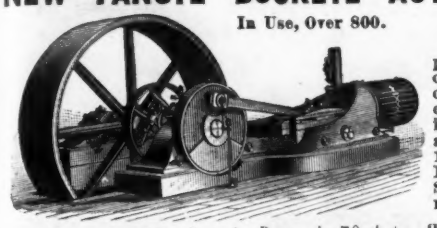

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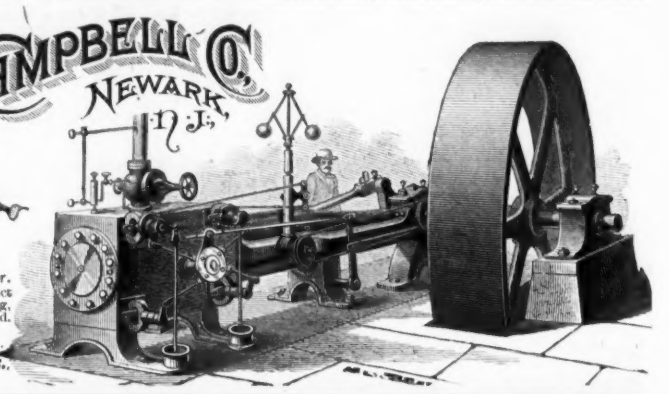

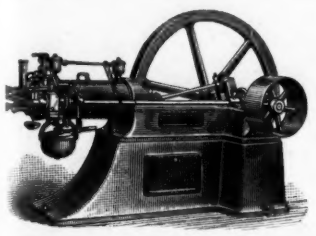

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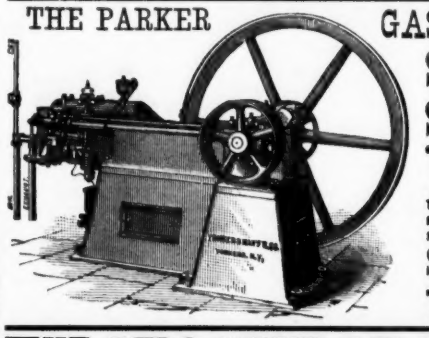

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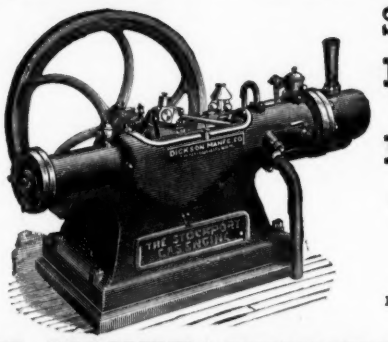

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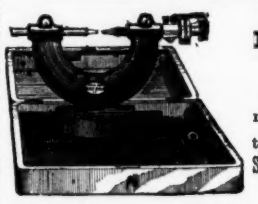

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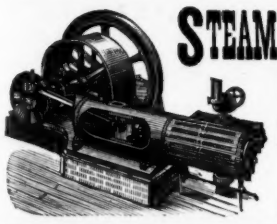

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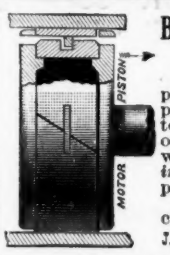

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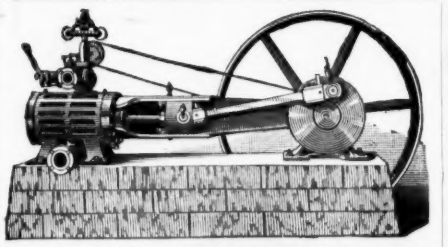

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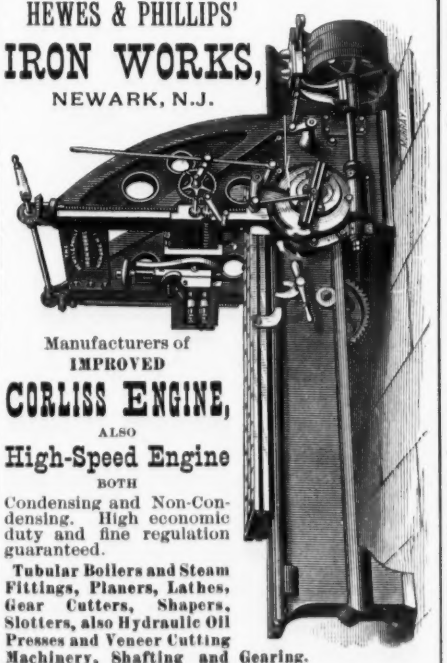

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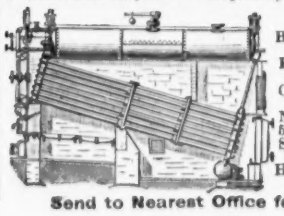

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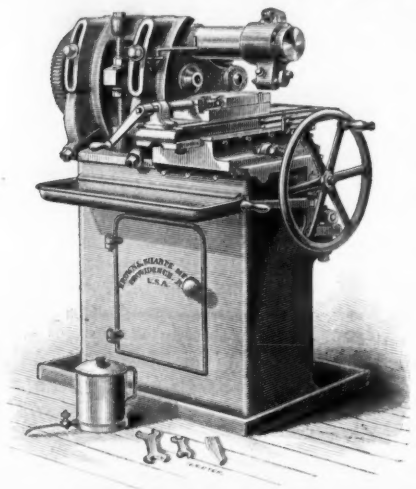

We have in our works and in constant use, about one hundred Milling Machines, and our experience with them has demonstrated that for manufacturing purposes where many duplicate pieces are required, that the best work is produced and the most economical results obtained from machines that are compact and solid, so arranged that the pieces operated upon can be quickly placed in position and quickly removed after the cut is taken.

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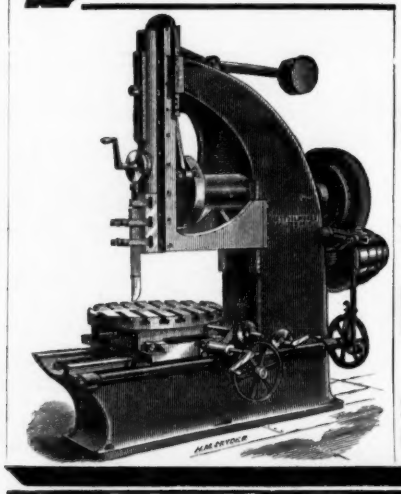

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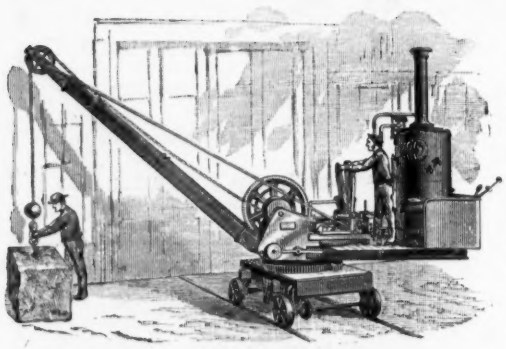

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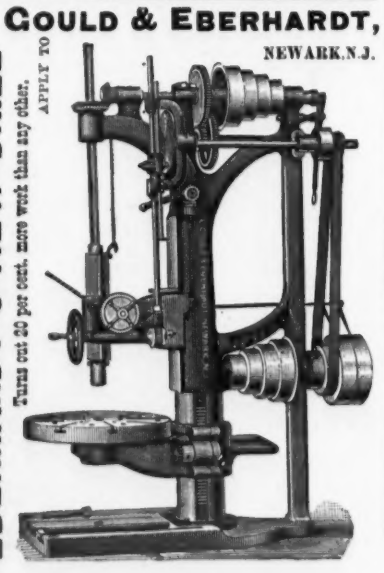

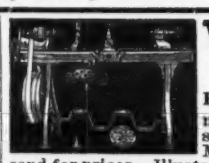

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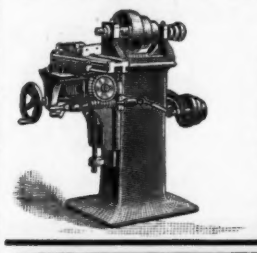

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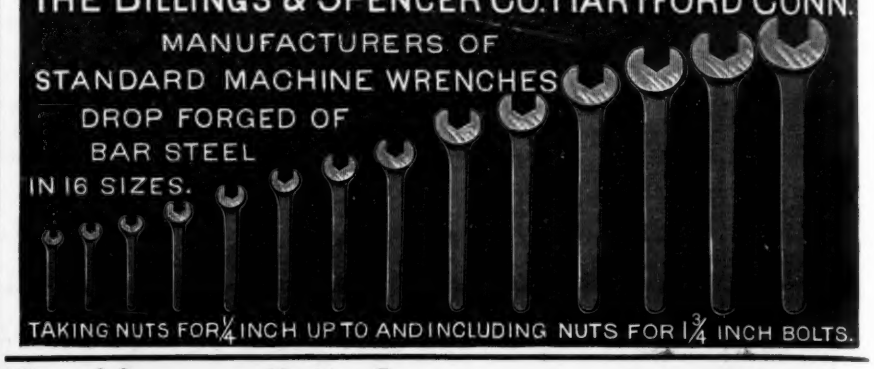

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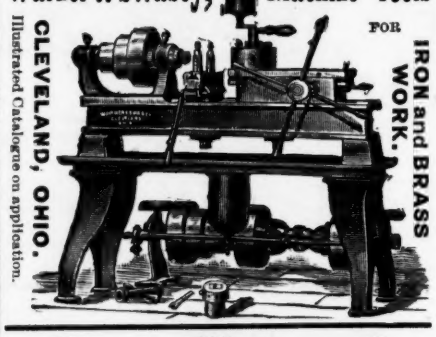

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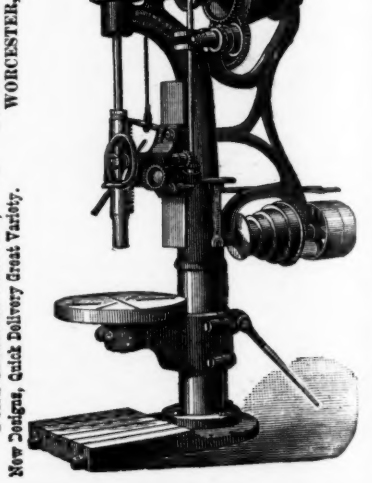

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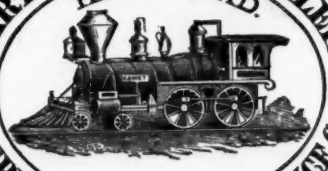

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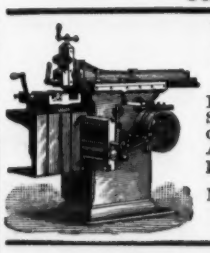

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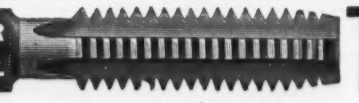

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